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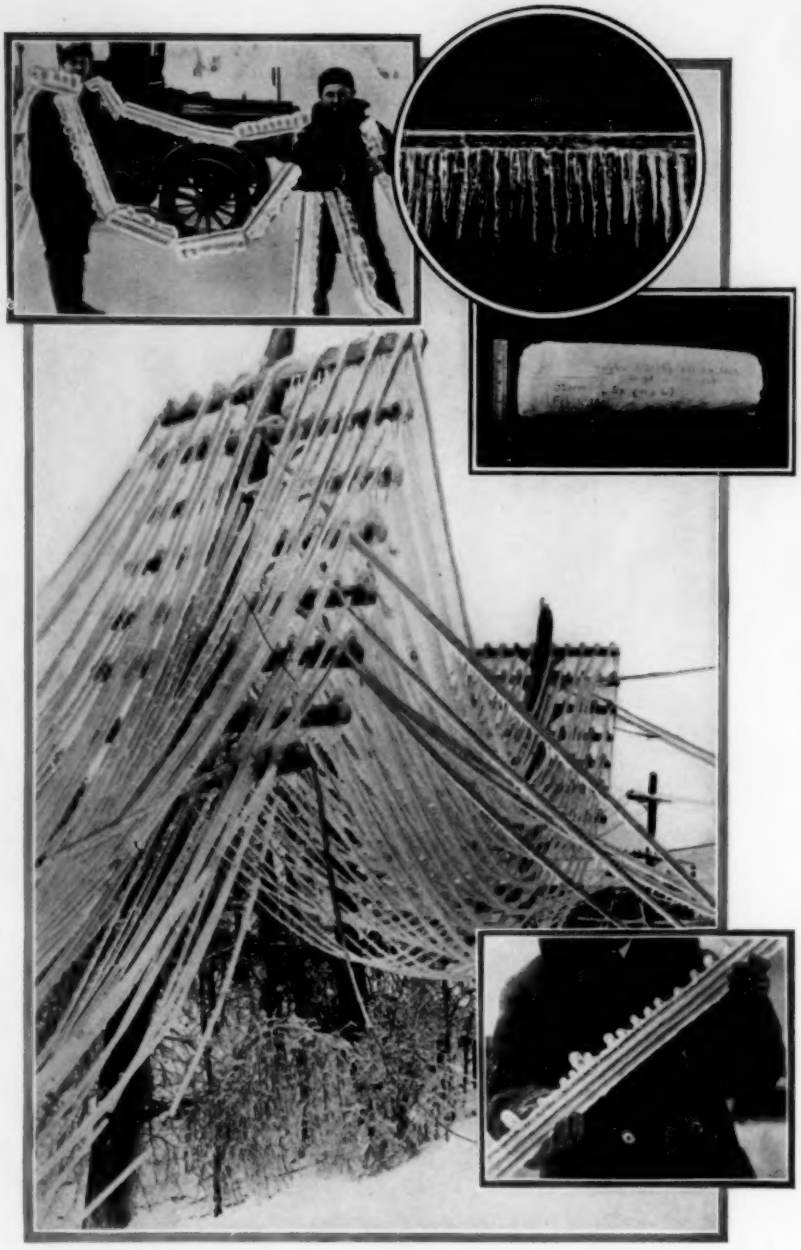

WHEN WINTER LAYS ITS HEAVY HANDS UPON THE WIRES

In small inserts, above and below, examples of sleet-encased wires. Below circle, plaster cast of sleet cylinder four inches in diameter.

BELL TELEPHONE QUARTERLY

A MEDIUM OF SUGGESTION AND A RECORD OF PROGRESS

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A Decade in Retrospect—1914-1924

THE first half disturbed by war, the second half disturbed by partial recovery from the war.

At the beginning of the decade a telephone user had the possibility of talking with any one of 7,960,000 stations between the Atlantic and the Rocky Mountains, or if he lived upon the Pacific Slope, with any one of 690,000 stations between the Pacific and the Rockies. The gap had not yet been bridged.

At the end of the decade he could talk with any one of 15,800,000 stations between the Atlantic and Pacific.

The service, besides being more extended, is better.

At the beginning of the decade at the average wages it required over 5 hours' labor to earn the average cost of a month's telephone service. At the end of the decade it required about 3½ hours' labor to earn the average cost of a month's telephone service.

These are some of the reasons why the demand for telephone service grows.

H. B. THAYER.

The Development of Development and Research

THE beginning of telephone development and research was made by Professor Bell and Mr. Watson in Mr. Williams' shop in Boston, where the first experimental work on the telephone was done. The product was the hand telephone—what we now call the receiver but which in the beginning was used also as a transmitter. When the first few hand telephones went out here and there in small quantities, each seemed to carry with it a lust for invention so that whoever received one of them began to experiment on methods of calling and, a little later, of switching. They carried the contagion of experiment and development with them. Everyone who knew anything about electrical work put his wits to work on the problems of the new plaything—telegraph operators, electric bell hangers and the small manufacturers of electrical goods, but Mr. Watson was keeping on at Boston, inventing, criticising, picking the good out of a lot of bad and advising the Bell licensees the country over who were beginning to make a business and a service out of the telephone.

To get a proper picture of the early days of the telephone it must be remembered that the applications of electricity were few and a knowledge of its practical working was confined to a few teachers and experimenters. Electrical engineering as a profession did not exist. The typewriter and the blueprint, now the favorite tools of the engineer, were in their infancy along with the telephone. Up to January 1881 two or three hundred licenses from The American Bell Telephone Company had been given—many of them licenses for a single city each. The licensees were not connected with each other. Except for a pioneering interest in the new business of telephony they believed that they had nothing in common. In fact, each one of them firmly believed that he was solving problems which had never been met before to meet

conditions which did not exist outside of the city in which he was operating. They were men of pioneering type, self-reliant and fertile in expedients.

A supply of necessary appliances could not develop as fast as the requirement developed and many materials now common to all parts of the electrical field had not been made available.

This paucity of materials is illustrated by a letter of 1879, from Mr. Vail to a manufacturer, transmitting advice from Mr. Bell as to methods which might be followed to produce a satisfactory quality of rubber covered copper wire. Expedients and makeshifts were necessary to progress.

By 1882 the Bell Telephone System, as a system, commenced to take form. In order to provide a supply of apparatus for the operating companies the formation of the Western Electric Company out of several small manufacturers and its inclusion in the Bell System had been arranged. The necessity for makeshift work by the operating companies diminished and the shops did more in producing the rapidly increasing types of apparatus needed. In Boston, out of the work of Mr. Watson, Mr. Berliner and those associated with them, there had grown what was called the Mechanical Department, which planned, experimented, invented, criticised and advised.

The material-producing functions of the different parts of the System had gradually developed into such a relation to each other that it seemed desirable to make certain changes in organization, which would more definitely recognize and crystallize the other valuable and distinctive work of development and research being done in increasing volume by this company's staff. This was done in 1907. Just previous to that reorganization, there were departments in the Western Electric Company, both in Chicago and New York, where the apparatus devised for the requirements of the System was developed into form for shop production. The Mechanical Department of the American Telephone and Telegraph Company had

grown into research and experimental laboratories for the development of some specific types of apparatus but more generally for consideration and development of a programme of scientific progress. The Bell Telephone System had become a very large business, although even then it was on the eve of a far greater growth. The entire plant at that time was less than additions to plant of two years on the scale of 1923 and a reorganization of these departments of work for greater efficiency was timely.

The reorganization of 1907 consisted of a consolidation of the Western Electric Company's shop design and laboratory work at Bethune and West Streets, New York, and an arrangement by which the Company should employ the Western Electric Company to do such work for us as required such laboratories and shops as they would provide there for their own work. The purpose was to avoid duplication of facilities as well as to get the greater efficiency coming from a closer contact between the staff of the Western Electric Company and our own. It brought to one point scientific study and research, manufacturing experience and operating experience and brought them all to bear most effectively on each problem. It simplified and expedited the work of the operating companies in that it established one point where all statements of requirements, suggestions of improvements or criticisms arising out of their operating experience could be considered and discussed from all points of view. As it developed in operation, all information as to immediate requirements of the system was made available to our engineers for study in connection with their own conclusion as to future possibilities, so that they had all the data upon which to lay out definite programmes for the improvement and extension of telephone plant to make possible the improvement and extension of telephone service. It was helpful in the standardization of apparatus.

The effect of this reorganization was to produce one

large organization, operated by the Western Electric Company, to do, for us and at our expense, the mechanical and laboratory work necessary in connection with our development programme. All mechanical work having thus been transferred, the organization of the American Telephone and Telegraph Company which had grown up as The Mechanical Department was renamed the Engineering Department.

In many manufacturing establishments the Engineers stop when a rough model is produced and the manufacturing department begins and carries on the work of design for economical manufacture. On account of the necessity of close contact with our Engineers involved in final approval by them of the article manufactured, the work of shop design is carried on by the Western Electric Company by their Engineering organization.

So that we had at the Bethune and West Street laboratory the scientists whose work involved laboratory facilities, the men conducting experiments, the shop design workers and the inspectors with a suitable equipment of laboratories and model shops available for all. The idea of our research and development scientists and engineers, worked out on paper or in rough mechanical form, was there developed into a finished piece of shop manufacture and after manufacture the product was then subjected to all of the tests necessary to satisfy our Engineers that it was worthy of introduction into or continuation in the plant of the Bell System.

Our Engineering Department at 195 Broadway continued to perform the function of studying the requirements of the Bell System and formulating them, prosecuting research and directing laboratory work for the account of this Company and advising with the Western Electric Company as to the production of new and old types of apparatus, and to carry on its other functions not directly connected with development and research.

After this reorganization there was no further change in organization until 1919, when it seemed desirable to

differentiate in our work between the engineering of the present and the engineering of the future by making two departments out of our engineering department, one called the Department of Operation and Engineering and the other the Department of Development and Research. Since then the study and standardization of methods of construction, maintenance and operation carried on by the Department of Operation and Engineering has made even greater progress than before, and we believe this change in reorganization has been of very great value. Development and Research has also profited greatly by the separation.

Now the time has come when, it seems, we can take another step forward with advantage. What was contemplated in the reorganization of 1907 has been entirely accomplished, in that the development, research and experimental work of the entire Bell System has been coordinated and has been concentrated as far as is desirable. The standardization of material is in effective operation. The different organizations composing the Bell System are working efficiently and harmoniously as parts of the greater organization, but this seems to be the time to get still more of the advantages in efficiency and economy which the consolidated organization now proposed makes possible. The expense of rendering the services which we perform for the operating companies has gone up as the value of the dollar has gone down. The telephone rates have not gone up in the same proportion and therefore the payments to us for these services have not. In this department of the System, as in all others, we must take advantage of all possible economies and methods working toward greater efficiency.

We propose to accomplish this greater efficiency by bringing our Development and Research Department and the Department of the Western Electric Company which runs the joint laboratory under the common direction of a Vice President of this Company.

In an organization of corporations this probably can

best be accomplished by incorporating the joint laboratory.

The new corporation will be a department of the Bell System. It will operate without profit, the expenses of its operations being assessed upon this Company and the Western Electric Company in proportion to the volume and character of work done.

The Vice President in charge of Development and Research of this Company will also be the chief executive of the new corporation, which will be named "Bell Telephone Laboratories, Incorporated."

H. B. THAYER.

The Relation Between Telephone Development and Growth and General Economic Conditions

Paper read by W. C. Helmle, at the Bell System General Commercial Engineers' Conference at New York, December 10-17, 1924.

THIS paper will first discuss some of the questions involved in the general relationship between economic conditions and telephone development, and then consider the specific problem of the effect of the fluctuations of business conditions upon telephone station gains. The conclusions offered here are in no sense final, but are the best current impressions obtained from studies which are carried on more or less continuously in the field of analyzing and forecasting the telephone market and the use of telephone service.

Market Indices

Following a practice more or less familiar to those handling market statistics, one may rank communities, or other units of territory, according to some index of economic conditions, and then compare their standing according to this index with their telephone developments; i. e., the number of telephone stations per 100 population. There are a number of such indices which show more or less definite relationships to telephone development. These include the ratio of automobile registrations to population, the proportionate number of income tax payers, the ratio of volume of bank debits to population, the relative number of salaried and professional persons as compared to wage earners, and the per cent. of native whites. Some of these figures are, of course, as much measures of social as of economic conditions. These indices of market character are about as closely related to business telephone development as to

residence development. A specific application of an index of this kind to telephone engineering is the use of residence rental values in commercial surveys of large cities.

Trends Affecting the Character of the Market

The general character of the market for telephone service appears to have undergone important changes in recent years. These changes seem to be reflected in the Bell System station gains, which have been quite high as compared with past trends, particularly in main stations, as distinguished from private branch exchange and extension stations. These recent large gains may be described further as chiefly urban and residence, but it is not clear that the proportionate distribution has changed much from past experience in these respects.

There are a number of reasons outside the telephone business for believing that the character of the market has changed. One of the most basic causes of the change in conditions is the gradual increase in the volume of production of the country, particularly when production is expressed on a per capita or man power basis. This is not a new trend, of course, as is shown by fairly comprehensive index series running back for some twenty-five years. It appears that the long trend of the volume of production per family, in other words, real income per family, has been rising about one per cent. per year. Objection sometimes is made to using production statistics to show economic improvement on the ground that production now runs more to luxuries and less to the substantial necessaries of life. We are concerned, however, not so much with whether people prefer automobiles to houses as with their capacity to buy what they want.

Changes in the character of the telephone market have been social as well as economic. An important factor which has operated since the war is the restriction of immigration and the more rapid Americanization of the

older immigrants. There is also involved here the growing up of the immigrants' children in American schools and surroundings.

There has been some change in the character of people's occupations in the direction of an improving market for telephone service. A strong tendency for the proportion of salaried and professional persons to increase relative to wage earners may be observed in successive reports of the Federal census for 50 years back. This is an accompaniment of the rising importance in industry of supervision, distribution, and selling, and a relative reduction in the labor required in actual production. The changing character of the business carried on and the improving social condition of the population attending the shifting of occupations favor continuing increases in both business and residence telephone development.

There have been, too, certain other changes in economic and social conditions favoring the telephone market. For many years women have tended to move away from domestic work to outside employment, thus increasing the family incomes and perhaps giving rise to broader interests in life. The gradual decline in the size of the average family has been almost entirely a decrease in the number of children, reducing the number of those dependent on the family income.

One may, perhaps, sum up most of these things in the statement that the real earnings of the mass of the urban population, particularly the industrial workers, have risen. Up to this point a number of factors have been considered in very broad terms without any very clear distinction between long time tendencies, apparent over periods of, say, fifty years, and more or less temporary modifications of these trends. According to the best information available, which is not as precise as might be desired, the advance in real income of any class of the population has not been a smoothly continuous process, but has been more or less affected by the business cycle and by other causes. A starting point may be taken for

convenience about 1900, since it is hardly necessary to go back farther for comparison with the telephone business, and because the earlier data are more uncertain in quantitative terms. It appears that from around 1900 up to 1914 the average city industrial worker secured little if any share in the economic advance made by the country as a whole, while the farmer was then securing a distinct advance in real income. No doubt individual members of the industrial class made some progress during this period, but the average condition was held down by the addition of many immigrants at the lower end of the economic scale. This tendency for the distribution of the increasing aggregate of real income to shift as between the industrial workers and the farmers was reversed just after the war, and the industrial worker has for the last three years or so had a substantially increased real income above the 1913 level by an amount of the order of 25 per cent.

It is interesting to note that the improvement in real earnings of the industrial classes has not affected all industries equally, although the underlying reasons for this are not entirely clear. Workers in the textile industries and in boots and shoes have benefited more than workers in the metal industries. It may be noted that the recent rise of telephone development has been, in general, somewhat greater in textile centers than in metal working towns in the same territory.

It is only fair to state that these conclusions regarding the trend of real income do not rest on any complete statistical basis, particularly for the pre-war years, but they are supported by various lines of evidence and probably are substantially correct. The question of a change in market character deserves special attention in the telephone business, because it is related to the question of the continuance of station gains at their present level, which is, for several territories, abnormally high as compared with pre-war experience.

Building Operations

The last business cycle, beginning in 1921, has been marked by an unusual volume of building. There have been other conspicuous features, notably the large production of automobiles and railroad equipment, but the building boom has attracted most attention from a telephone standpoint. An analysis of the available data shows the "boom" element to have been confined largely to residential building. Commercial and industrial building appear to have had a relatively even course, as compared with residential building. Two charts are presented here, showing the distribution of building activity territorially. The figures are reduced to comparable units by dividing by the number of families in the population of the cities represented. On Figure 1 it should be noted that the Southern States show at a relative disadvantage on a valuation basis, because the reported valuation per family accommodated by the new building is particularly low in the South. It is also low in the Southwestern, Mountain and Pacific territories. In other words, if the chart were made up to show the number of families provided for, these districts would rank relatively higher. Figure 2 shows building operations for 20 large communities. The outstanding feature is the remarkable volume of residential building in New York City, amounting in value to almost 30 per cent. of the total for 232 cities. These building permit data are somewhat affected by various technicalities in compilation, but they probably are satisfactory for observing the course as between different years, or for general comparisons of different territories.

Various attempts have been made to relate the building statistics to telephone station gains, but without any very definite conclusions. Some relationship to station gains is apparent for both residence and business service, but it is not very close either by operating company territories or by individual communities. This may

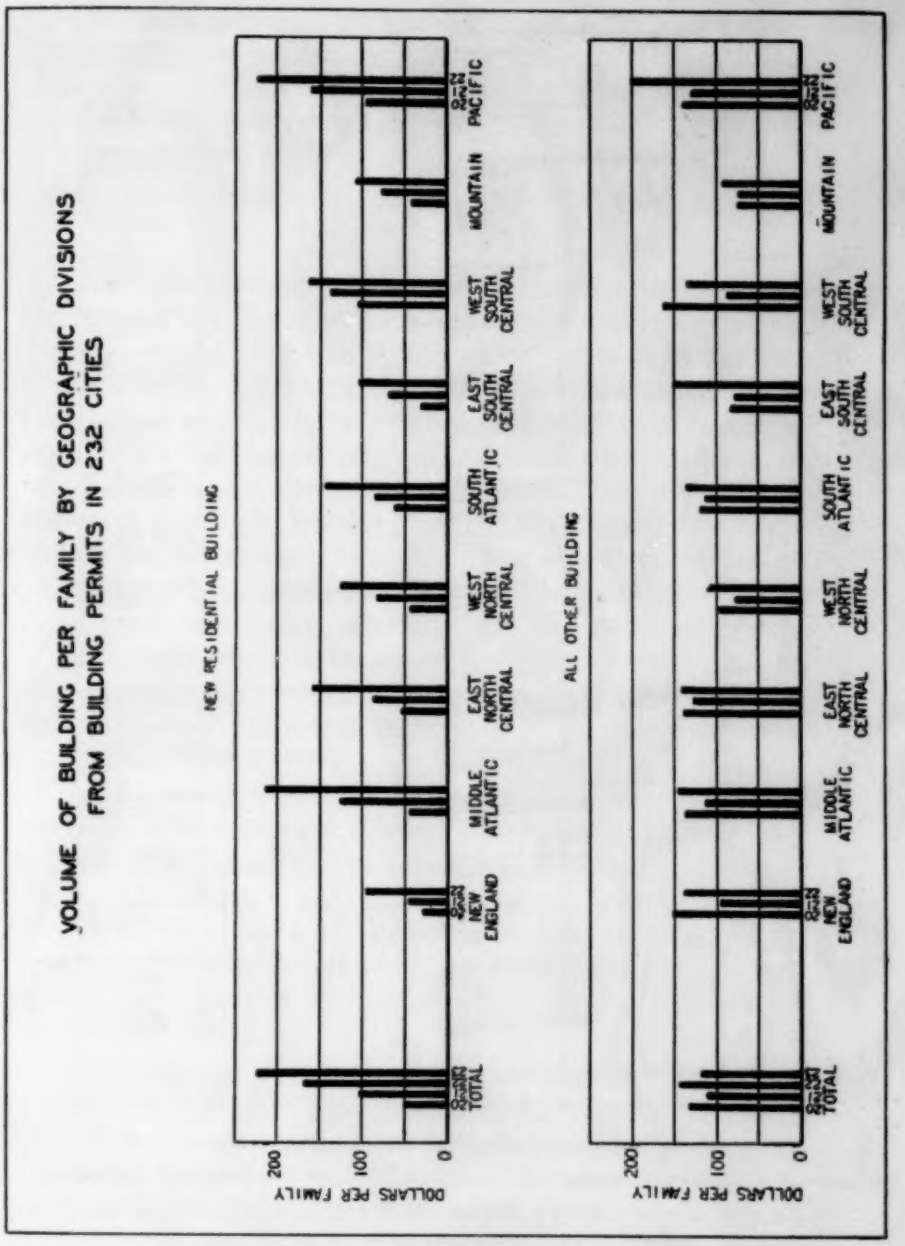
VOLUME OF BUILDING PER FAMILY BY GEOGRAPHIC DIVISIONS
FROM BUILDING PERMITS IN 232 CITIES
NEW RESIDENTIAL BUILDING
ALL OTHER BUILDING
DOLLARS PER FAMILY
200
100
0
TOTAL
NEW ENGLAND
MIDDLE ATLANTIC
EAST NORTH CENTRAL
WEST NORTH CENTRAL
SOUTH ATLANTIC
EAST SOUTH CENTRAL
WEST SOUTH CENTRAL
MOUNTAIN
PACIFIC

Figure No. 1

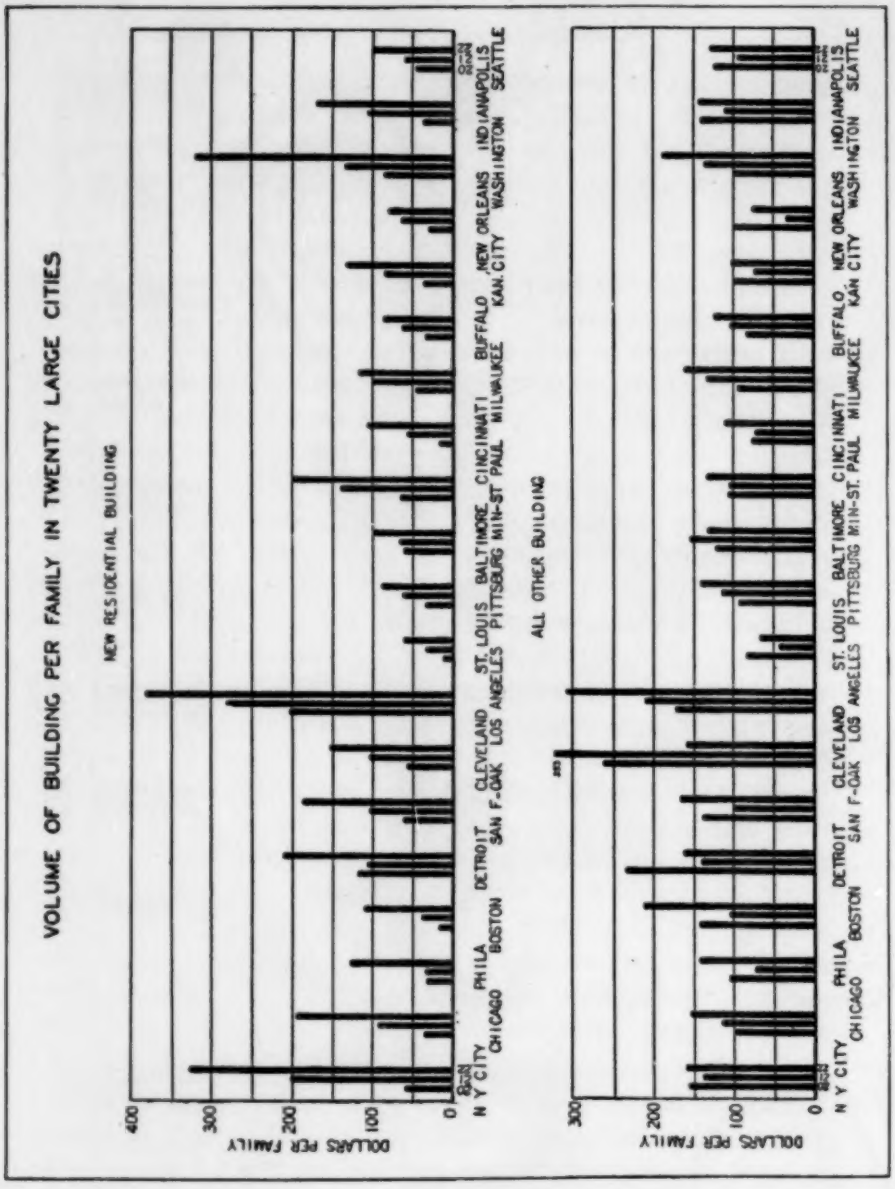
VOLUME OF BUILDING PER FAMILY IN TWENTY LARGE CITIES
NEW RESIDENTIAL BUILDING
ALL OTHER BUILDING
DOLLARS PER FAMILY
0
100
200
300
400
N Y CITY
CHICAGO
PHILA
BOSTON
DETROIT
SAN F-OAK
CLEVELAND
LOS ANGELES
ST. LOUIS
PITTSBURG
BALTIMORE
MIN-ST PAUL
CINCINNATI
MILWAUKEE
BUFFALO
KAN CITY
NEW ORLEANS
WASHINGTON
INDIANAPOLIS
SEATTLE

Figure No. 2

be explained, perhaps, by the fact that only about one-third of residence station gain is ordinarily due to increase in the number of families, and two-thirds to growth of the percentage development.

General Business Conditions vs. Telephone Station Gain

The relationship between prevailing business conditions and telephone station gains is interesting as an overall problem for the Bell System, as well as for the more specific forecasts for operating company territories and smaller units. This relationship appears to be a much less satisfactory basis for analysis and forecasting for single communities than for company territories or the Bell System as a whole, because of both logical considerations and the unsatisfactory results as yet obtained for particular cities. The smaller the unit considered, the more important are the localized effects of any restriction of facilities which may exist and of rate changes. The larger the unit considered, the more likely are such influences to be evened up, one year with another.

It is more or less obvious that the regional incidence of general business conditions is very important in the telephone business. General business activity, the volume of production and trade, is of greatest interest in studies of telephone station growth. It may be noted, however, that there are some reasons for believing that speculation has an important effect on the volume of traffic over toll lines.

The major movements of general business conditions probably affect all sections of the country at substantially the same time, but their local influence may be profoundly modified by special conditions. We may take as examples the continued growth on the Pacific coast, which reduced the severity of the depression of 1921, or the recent depression in Northwestern agriculture, which

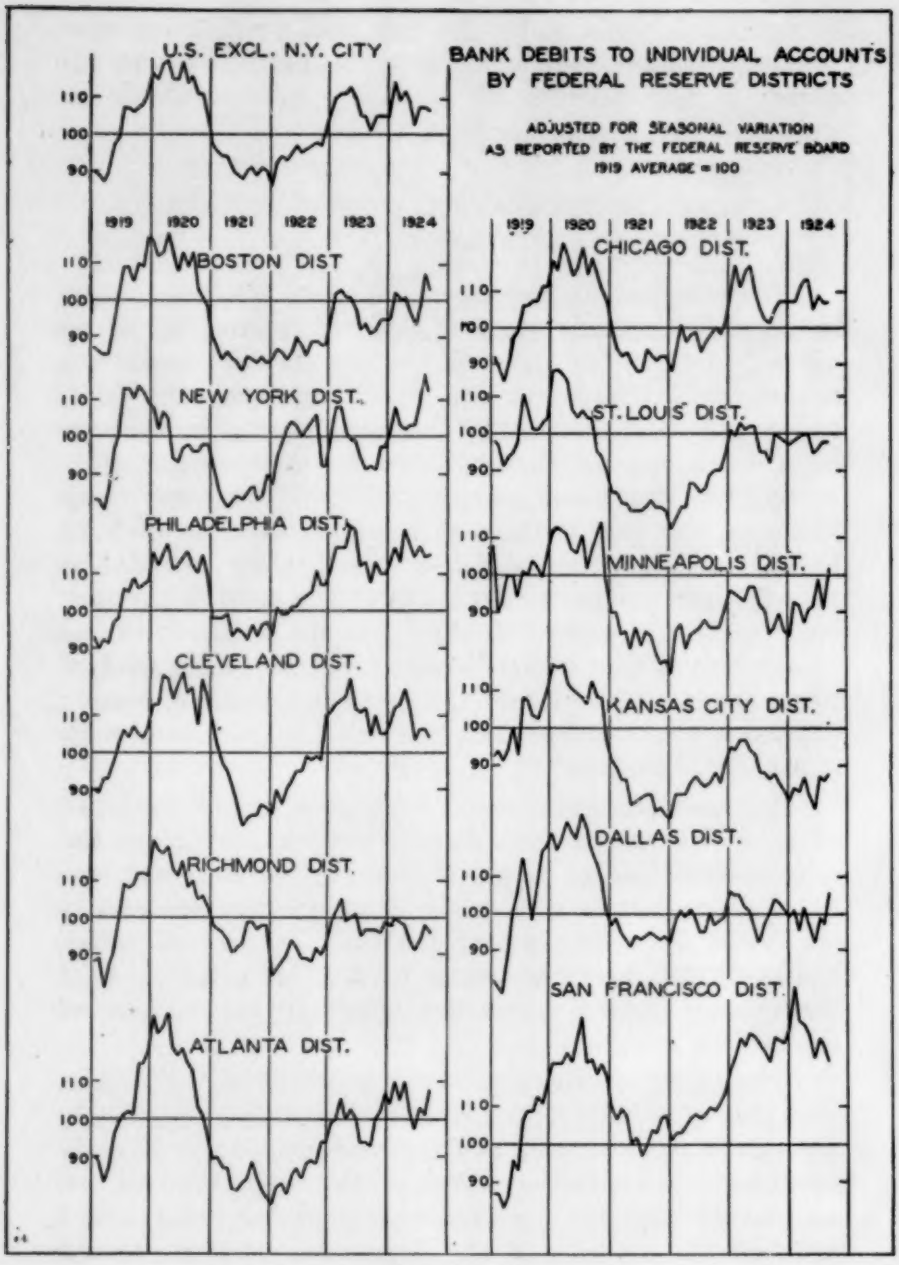
BANK DEBITS TO INDIVIDUAL ACCOUNTS
BY FEDERAL RESERVE DISTRICTS
ADJUSTED FOR SEASONAL VARIATION
AS REPORTED BY THE FEDERAL RESERVE BOARD
1919 AVERAGE = 100
U.S. EXCL. N.Y. CITY
BOSTON DIST
NEW YORK DIST.
PHILADELPHIA DIST.
CLEVELAND DIST.
RICHMOND DIST.
ATLANTA DIST.
CHICAGO DIST.
ST. LOUIS DIST.
MINNEAPOLIS DIST.
KANSAS CITY DIST.
DALLAS DIST.
SAN FRANCISCO DIST.
1919
1920
1921
1922
1923
1924
110
100
90

Figure No. 3

made the revival of 1923 a very mild one. These things appear from a regional study of banking statistics. One set of banking figures, those for debits to individual accounts, is shown on Figure 3 arranged by Federal Reserve Districts. Bank debits are quite closely related to the activity of general business, but it should be remembered that these figures, expressed in dollar values, are affected by changes in price levels. There are some differences in the timing of the movements of business in different sections of the country, but this variation depends on differences in the type of industry rather than on matters of geography. Different industries have shown distinctly different timing of the alternations of prosperity and depression. It is therefore appropriate to consider an index of general business conditions in making forecasts for a section of the country, but only with reservations for local conditions superposed on the broad swings of business in general.

Business conditions in certain sections are quite definitely related to the condition of agriculture. Without attempting to distinguish between such branches as grain, livestock, and cotton growing, certain general principles may be set down as pertinent in any region. Industrial prosperity and depression have little direct effect on the farmer, whose crops depend on the weather, and whose selling prices depend largely on world conditions. On the other hand, farm prosperity has a definite relation to industrial conditions. This is not only because the farmer has increased buying power, but also because the farmers, as they come out of a depression, pay off their debts, putting funds in the hands of merchants, bankers and mortgage holders.

Analyses of the effects of general business conditions on station growth have been in some degree limited by the available data, and disturbing effects are sometimes introduced into the station data by variations in administrative definitions and practices. More serious difficulties arise from the shortage of facilities resulting from

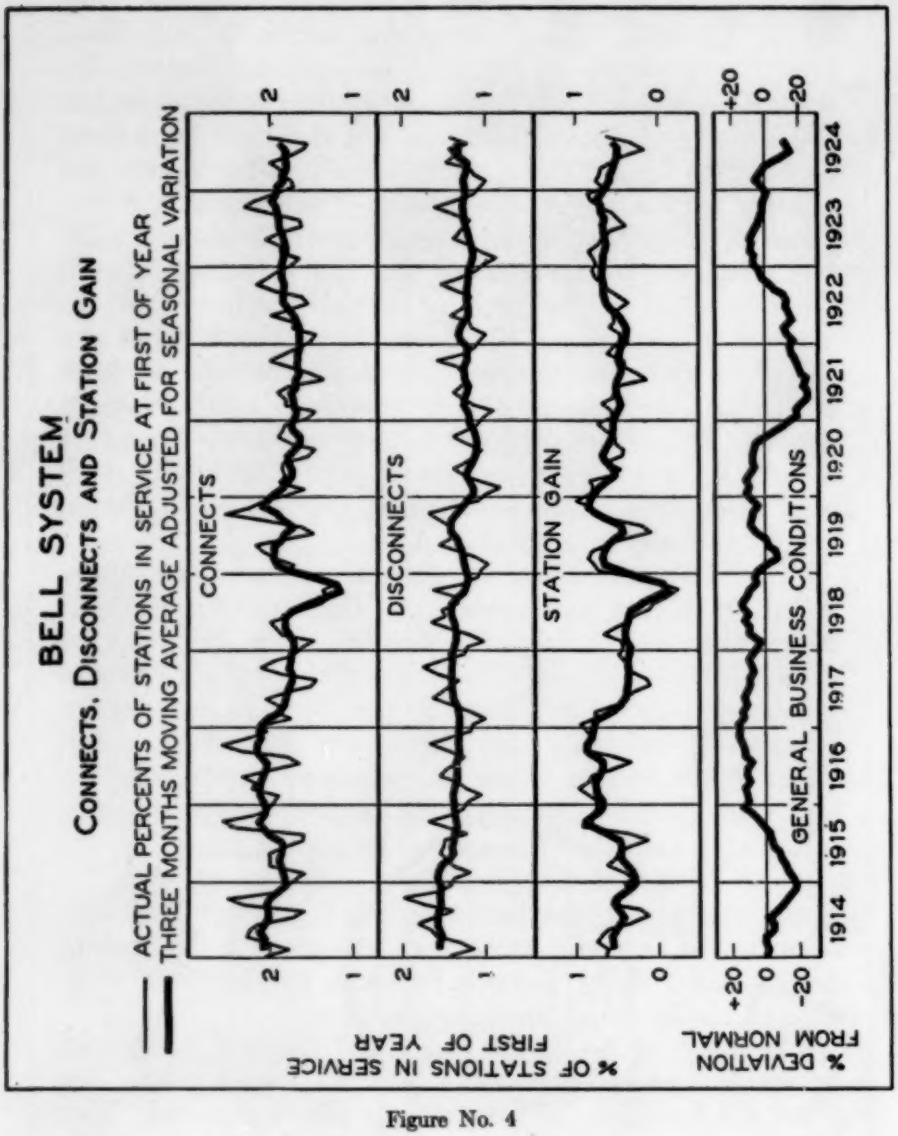
BELL SYSTEM
CONNECTS, DISCONNECTS AND STATION GAIN
ACTUAL PERCENTS OF STATIONS IN SERVICE AT FIRST OF YEAR
THREE MONTHS MOVING AVERAGE ADJUSTED FOR SEASONAL VARIATION
CONNECTS
DISCONNECTS
STATION GAIN
% OF STATIONS IN SERVICE FIRST OF YEAR
% DEVIATION FROM NORMAL
GENERAL BUSINESS CONDITIONS
1914 1915 1916 1917 1918 1919 1920 1921 1922 1923 1924

Figure No. 4

the wartime deficit in installations; the backed-up demand for service has been a very considerable factor in certain places. Annual data have been examined for station gains for single communities, with residence and business service separated, and for Associated Company territories, with the large cities separated from the remainder of each territory. The monthly data studied are separate series of connections, disconnections and station gain for company territories, and also, in a few cases, classified data for individual cities. A subdivision of the station data into business and residence classes is helpful because it parallels a corresponding division in the market.

The series of station connections, disconnections and net gain for the Bell System are shown on Figure 4. These data have been corrected for purchases and sales, but not for losses of duplicate stations involved in mergers with competitive properties.

It appears that the fluctuations of station gain are more in residence than in business service. As between large cities and the remainder of an operating company's territory, the year to year fluctuations are generally similar, but for most of the companies the relative level of the gains has been higher in the cities. Although the smaller towns as a group behave much like the large cities, for individual communities the fluctuations are wider and more erratic in the smaller places. It appears that the course of station gain in any one city, particularly for residence service, may deviate quite widely from the average, and from the course of general business. Among cities of over 50,000 population, there appear to be no significant relationships between recent rates of station gain and either size of population or number of stations. Likewise, gain per cents. appear to be unrelated to city character, and they average only slightly lower in cities which are already highly developed.

Fluctuations in station gains are due chiefly to fluctuations in the rate of connections rather than discon-

nections. The various operating companies behave more alike with respect to gains than connections, and connections than disconnections. It may be found occasionally that the short time fluctuations of connections and disconnections tend to occur at the same time and in the same direction. This, together with the fact that the seasonal movements of the two series are roughly similar, may give rise to the theory that in times of active business both connections and disconnections increase, the connections to a greater extent, of course. This theory, however, appears on more careful analysis to have no general application.

The amount of effect on station gains of a specified change in business conditions is of special interest. This quantitative effect appears to vary among the Associated Companies, or for different cyclical swings in the same company, although the abnormal war years have been excluded in drawing conclusions. A one per cent. change in general business activity corresponds to a change in station gain of from one to four per cent., averaging between two and three. A rise in station gain along with better business conditions results chiefly from increased connections, typically accompanied by a slight decline of disconnections. In some instances, however, a change in disconnections, a fall with better business or a rise with worse, has been sufficient to have a substantial effect on station gain.

The relative timing of movements of general business and station gains is not entirely clear. From the evidence at hand, it appears that there is no regular lead or lag of either station gains, connections or disconnections relative to general business. This matter of timing, and also the quantitative relationship, may be tested with greater precision when a more comprehensive series of regional business indices becomes available.

In connection with these studies it has been necessary to adjust the past station data to allow for seasonal variation. This problem is related to two others, distributing

an annual forecast to months of the year, and deriving an indicated year's performance from the actual performance for any given number of months. It appears that the usually accepted methods have certain inherent defects when applied to station gain data, but it is not entirely clear whether theoretical refinements of method result in any practical advantage.

The ultimate object of studies of this kind is to assist in the forecasting of station performance, and the more important conclusions of this section may be summarized as they affect the short-period forecasting of station gains. General business conditions have an effect on station gains which should be taken into account in forecasting. It must be recognized that a forecast of general business activity contains possible errors, and that local station performance is affected not only by the general business cycle, but by local economic conditions and by local telephone conditions, such as rates and possible restriction of facilities. The time relationship between business conditions and station performance has not been consistent in the past, and neither a lead nor a lag of the telephone series appears to be justified. We may assume for the present that station performance and general business fluctuate together, recognizing, however, that a variation of several months is possible in any particular case. The amount of change in station gain produced by a given deviation of general business from normal has also been more or less irregular in the past. It appears that a variation of one per cent. in business conditions will produce a corresponding variation of two per cent. or three per cent. in station gain, but this factor may vary from one per cent. to four per cent. and still be reasonable. The effect of an improvement in general business on station gain is, in general, produced chiefly by a rise in connections, and to a less extent by a fall in disconnections. A decline in business conditions has opposite effects.

W. C. HELMLE.

NOTE—Mr. Helmle is of the staff of the Commercial Engineer of the American Telephone and Telegraph Company.—*Editor.*

Mobilizing for the Fight Against Sleet

EDITOR'S NOTE.—*Although sleet storms during 1924 were unusually severe, less than one per cent. of Bell System telephone poles were affected. Toll cable plant is much less affected than open wire construction. Of the System's toll wire mileage, 54% is now in cables, and such has been the progress of the telephone art that of the toll wire added in 1924, 80% has been in cables.*

AGAINST the menace of a sleet storm such as that which made its way from Texas to the Canadian border on December 18, 19, 20 and 21, 1924, a telephone system has no defense except the foresight of its management and its employees' loyalty, willingness to cooperate and devotion to the public service.

Rain and a freezing temperature—these are the simple elements of a sleet storm. Drops of moisture fall steadily, turning to ice as they cling to any surface upon which they strike. Trees and shrubs sag beneath their crystal coating and every bough and twig sparkles with its gemlike pendants—to the lover of the beautiful, one of the most splendid of Nature's fantastic creations.

But to the practical telephone man, this same picturesque deposit of ice means a battle to be fought for the maintenance of service; a battle against heavy odds, calling for every ounce of resourcefulness, of stamina, of grim courage and of devotion to duty he possesses.

For sleet deposits sometimes reach almost unbelievable proportions. In a historic storm in New England in February, 1898, for example, the formation of ice was so astonishing that a plaster cast was made of one of the ice-encased wires by the New England Telephone and Telegraph Company as a permanent record. This cast is now exhibited in the Bell Historical Museum, New York. It shows that the wire, with its coating of ice, weighed 3.2 pounds to the linear foot and 41.64 pounds to the cubic foot. Frequently the cylinder of sleet is accom-

panied by icicles several inches in length. Translated into terms of telephone plant in actual use, such a deposit of ice may mean that, although the weight of the wires in the normal span between two poles of a 40-wire lead is less than 200 pounds, the ice coating may add a weight of about 15,000 pounds to the load supported by each pole.

This New England storm was, of course, an exceptional case. But even a sleet storm of ordinary severity presents problems which are among the most baffling of all those involved in maintaining uninterrupted telephone service. Pound after pound of ice is added to the normal weight of wires and poles, so that in many cases the wires snap beneath this enormous weight, even if no other factors are involved. If the storm is accompanied or followed by high winds, the danger of breaks becomes more serious still, as it does in the event of protracted periods of low temperature, during which the contraction of the ice-laden wires is likely to cause them to snap. Not infrequently the weight of the ice is such that the poles themselves are broken off and fall to earth, carrying a tangle of wires with them. Even though wires and poles remain intact, the weight of ice sometimes stretches the wires and causes them to sag badly, making replacements necessary.

Such were the problems with which the Long Lines Department of the American Telephone and Telegraph Company and the Bell System Associated Companies in the territories affected had to deal in repairing the damage done by the storm of which this article treats.

From Texas to the Great Lakes

The storm first manifested itself, in so far as it affected the lines of the Bell System, on the morning of Thursday, December 18, when snow and an abnormally low temperature were reported in northern Texas and adjacent territories. By the time it had reached Missouri the snow had changed to a drizzling rain, accompanied by a sudden

drop in the mercury and high winds. The territory affected comprised a belt, roughly 150 miles in width, extending in a northeasterly direction from northern Texas through Oklahoma, Missouri, Illinois, northern Indiana and portions of Michigan and Ohio.

Of the larger cities St. Louis, which was almost at the eastern border of the storm-swept zone, was much harder hit than many localities nearer the center of the path of the storm. By the nineteenth the city was almost completely isolated, all forms of wire service and rail communication being disrupted. Thirty-six trains, due in the city on the evening of the eighteenth, were completely lost, being stalled en route and being prevented from reporting their whereabouts by telegraph or telephone.

Within the city itself, as in dozens of other cities that lay in the path of the storm, all public utilities were hard hit. Trees were toppled over, carrying communication and light and power wires to earth with them; street railway traffic was tied up; motor trucks and passenger cars, and even pedestrians, found their way blocked by the debris which littered the highways.

Service to the east of St. Louis was also affected, though not so seriously as that to the west, because of the fact that the city was near the eastern border of the storm zone. There was a period of some hours, however, when the only communication with the city from any direction was a circuit—and that one picturesquely described by the plant department people as "wabbly"—running to the northeast and giving communication with the outside world through Vandalia, Ill.

The situation in Missouri is more or less typical of that in most of the states through which the storm made its way, though in portions of the storm belt the damage was, of course, much less serious than in others.

Each of the local operating companies had its problem—and a serious problem, indeed—in restoring damaged circuits for purely local purposes. The courage, the

resourcefulness and the devoted loyalty with which the repair gangs of these companies went about the task of restoring service is a romance in itself. But it is not with the local aspects of the situation that this article primarily deals.

Nation-wide Service Affected

Through the storm-swept region ran the long distance circuits of the American Telephone and Telegraph Company, the main arteries, as it were, of a nation-wide telephone service. Interlaced in a veritable network of open wire and cable, they provided communication, not only between the cities within the territory affected, but between hundreds of other cities to the east and to the west, extending to the two shores of the continent.

In the restoration of service through this storm-swept belt, therefore, San Francisco and Boston were as vitally concerned as was St. Louis itself. Telephone users in Los Angeles and in Seattle, in New York and in Philadelphia were depending upon that service—a service which had been continent-wide a few hours before and which now had been practically divided into two isolated sections. The storm had, in effect, brought back conditions similar to those that existed before the completion of the Transcontinental Line. Until this line was put into service, telephone communication was possible as far west as the Rockies, from the East; and as far east as the Rockies, from the West, but along these mountain heights ran a wide belt which the telephone art had not yet penetrated with its highways of speech. In a few hours this storm had undone, for the time being, the work of a decade, for the devastated area formed as complete a bar to communication as the unbridged territory atop the Rockies ever had. A nation-wide service had been affected and its restoration was a matter of national concern.

It is to be remembered, too, that these same wires running through this devastated zone provided additional

circuits devoted to what is known as special contract service; that is, private telegraph or telephone service for Government departments, the press or press associations, and bankers, brokers or other commercial houses. Many of these circuits were also seriously affected.

Getting the Circuits Through

As has been said, the storm began at the southern end of the affected belt on the morning of December 18, and continued in various parts of the territory until the twenty-first. But a report dated the twenty-second showed that at least some circuits had been restored to service between Chicago and New York, Philadelphia, Boston, Pittsburgh, Toronto, Cleveland, Indianapolis, Nashville, Omaha, Denver and San Francisco.

St. Louis, where the isolation had been almost complete, was getting practically normal service to the East and could reach the Southwest by way of Memphis and Little Rock.

Circuits devoted to special contract service had also been sufficiently restored so that between New York and Chicago and points beyond it there was at least one wire apiece for users of this private-wire service. Even in territories much harder hit by the storm, circuits were being given to the Government and the press.

To be sure, some of these restored circuits were of a temporary nature and consisted of nothing more than insulated, "twisted-pair" wire stretched along the ground or fastened to the broken stubs of poles, trees, fence posts or any other available object, much after the manner of the temporary communication lines run by the U. S. Signal Corps across the battlefields of France during the World War.

Each day brought its report of gains—a few circuits here, a score or more there; poles erected at one point, and, at another, wreckage cleared away and normal conditions restored.

These gains were won, however, at the cost of tremen-

dous effort. The thermometer remained below or near zero at a number of points affected by the storm for several days after the first break occurred. As a result, the heavy coating of ice remained on the tangle of wires which had fallen, making it unusually difficult to clear up the wreckage. These conditions also made it necessary to establish patrols on lines after they had been restored to service, as they were continually breaking on account of contraction due to cold. Even on lines which had not broken, the weight of ice was so great as to make the wires much more susceptible than under normal conditions to breakage through contraction.

The anxiety of the Bell System plant department was increased on December 24 by the threat of a renewed attack upon their lines. Just as reports from the Middle West seemed to indicate that the situation was well in hand, sleet began to fall in northern New York, in parts of Pennsylvania and throughout portions of the New England States. This attack proved, however, somewhat in the nature of a feint and no serious damage resulted from the incipient storm.

Mobilizing the Bell Forces

Now, how does the Bell System go about the task of meeting a situation like this? As pointed out in the opening paragraph of this article, the foresight of management and the loyal, devoted cooperation of employees are the two primary factors involved in mobilizing the men, materials and resources of the system to meet an emergency of this character and proportions.

A word as to what executive foresight has done to make such a mobilization possible. This phase of the matter goes to the very foundation of the Bell System organization structure. This organization, as the reader doubtless knows, consists of a parent company, the American Telephone and Telegraph Company, and twenty-five Associated Companies, each of which is

essentially an operating unit, responsible for local service within its own territory.

The Long Lines Department of the parent company is responsible for the construction, maintenance and operation of the long distance lines which link these local operating companies together into a single, nationwide system. The parent company performs for its Associated Companies a number of highly valuable services, among which are several that are of particular importance in connection with the subject now under consideration.

The Western Electric Company, which the American Telephone and Telegraph Company owns, acts as the purchasing agent for each of the parent company's Associated Companies, as well as for its Long Lines Department. As will be seen, this arrangement is of particular importance in making possible the prompt provision of the materials required in the repair of storm damage and the restoration of service.

The Value of Standardization

Through its Development and Research and Operating and Engineering Departments the parent company is continually engaged in developing, improving and *standardizing* equipment and methods for use throughout the entire system. This phase of the American Telephone and Telegraph Company's functions assumes peculiar importance in times of emergency such as that created by a severe sleet storm. For it means, not only that the equipment used in making repairs in the affected area is exactly like that used in all other parts of the country, but that Bell System repair gangs, everywhere throughout the system, have been taught to use this material in the same way. In other words, when a repairman is shifted from Georgia to Missouri or Illinois, and set to work repairing storm damage, he finds the same size and quality of line and "tie" wire, the same type of insulators, the same sort of poles and

cross arms as those with which he has been familiar at home. And in the use of these materials he will follow standardized practices which he already knows by heart.

All of which makes for a degree of elasticity or fluidity, as it were, in the organization structure, without which nation-wide service could be maintained, if maintained at all, only at enormous cost. For this ability quickly to mobilize its man-power, shifting its forces to the points where they are most needed, is not only a fundamental of efficient, uninterrupted service, but a fundamental of a service that is kept at a minimum of cost to the telephone user.

It would be possible, of course, to assign to every long distance route a maintenance force sufficient to care not only for normal, everyday requirements, but for emergency requirements as well. But it is obvious that this would result in an enormous increase in overhead charges, which would have to be passed on to the users of the service.

As an alternative to this costly arrangement, the Bell System has chosen to keep its maintenance forces, for both local and long distance purposes, within the limits of normal needs, and to provide protection against emergencies by making possible the rapid mobilization of its man-power.

The Reserves Go Into Action

Within a few hours after this particular storm set in, for example, it became apparent that it was to be one with which the local forces of the parent company and many of the Associated Companies in the affected territory would be inadequate to deal. Out to other sections of Long Lines Department of the American Telephone and Telegraph Company, and to the nearer of its Associated Companies, went requests for help—calm, businesslike, but not the less insistent requests which left no doubt as to their urgency.

The response was immediate. From Kentucky, Ten-

nessee, Georgia, Maryland, from Nebraska, Iowa, Wisconsin and unaffected parts of Indiana, and even from as far east as Pennsylvania, the gangs of repairmen moved, each to the place where it was most needed and which it could reach in the shortest space of time, to undo the work which Nature had done in her devastating sweep from the Gulf to the Great Lakes.

Into the Missouri territory the Southern Bell Telephone and Telegraph Company and the Cumberland Telephone and Telegraph Company sent some 235 men, while outside divisions of the Long Lines Department of the parent company provided approximately an equal number. In the northern section of the storm area the nearby Associated Companies were, of course, first to get their men into action. Indiana, for example, sent ten men to the Illinois Bell Telephone Company and 31 men for work on the long distance lines, while the Wisconsin Telephone Company provided 24 men to the Illinois Company and 128 for work on the circuits of the Long Lines Department. The Northwestern Bell Telephone Company put 123 men at the disposal of the parent company. Similarly the Ohio Bell Telephone Company rushed eight gangs, or 56 men, into the territory of the Illinois company.

Meanwhile the more remote companies of the East had received and were responding to calls for assistance. The New York Telephone Company provided twelve gangs, 76 men; the Pennsylvania Bell Telephone Company fifteen gangs, or 97 men, and the Chesapeake and Potomac Telephone Company eight gangs, or 50 men.

It is noteworthy that some of the Associated Companies, like the Southwestern Bell Telephone Company and the Illinois Bell Telephone Company, which were themselves hard hit by the storm, provided men for work on the long distance lines.

The result of this rapid mobilization of man-power was that, almost before the storm had subsided, the local repairmen, who had gone on duty at the first report

of trouble, found groups of their fellows, whom they had never seen before but who were indeed their comrades in a common cause, working side by side with them in the restoration of service.

Mobilizing Materials

But an army of repairmen without proper materials and supplies would be as helpless as an army of soldiers without weapons or ammunition. While these men were being hurried to the point at which they were to begin their fight against sleet, another mobilization had been under way—the mobilization of materials.

Properly speaking, the supplying of materials for the repair of storm damage is not a mobilization, in the sense that the term is used as applied to the movement of men into the storm area. For, long in advance of the snapping of the first wire or the falling of the first pole, adequate materials had been provided to care for such damage in the event that it might occur.

As has been stated, the Western Electric Company is virtually the Supply Department for the entire Bell System. With the exception of wooden poles and cross arms, most of the materials which it manufactures itself are produced at its great factory in Hawthorne, near Chicago. This point is, accordingly, the center of its vast distributing system in so far as its own products are concerned. But it is obvious that efficient distribution never could be accomplished by keeping stores of supplies at this central point alone, and accordingly a number of distributing points have been established throughout the Bell System—advance supply bases, in effect. To these distributing points are also shipped, direct from the manufacturers, such supplies as the Western Electric Company buys from outside concerns.

A Nation-wide Supply System

Of these large supply warehouses there are thirty-one throughout the country. They have been located at

strategic points, both circuit congestion and probable storm damage being taken into consideration in selecting the city in which each has been placed. Incidentally, the engineers of the Bell System have made an intensive study of sleet storms, covering a period of twenty-five or thirty years or more. On the walls of the department charged with this branch of research work may be seen huge maps of the system, dotted with glass-headed pins of various colors, each with its own peculiar significance as a record of weather conditions for the area in which it has been placed.

Accordingly, these engineers have arrived at definite conclusions as to at least the probabilities regarding the prevalence of sleet storms in various parts of the system and, in so far as so capricious a thing as the weather may be judged by probabilities, are thus able to plan in advance for certain contingencies likely to occur.

All of this painstakingly collected information has been given weight in selecting the points at which distributing houses have been located. It is given even greater weight in determining the quality and character of supplies to be carried in stock in these territorial distributing houses.

In other words, each warehouse carries supplies that are adequate for its normal construction and repair needs, and in addition thereto what might be called an emergency margin—a reserve stock of wire, insulators, hardware, etc., sufficient to care for at least the immediate needs which may arise from damage by storm, flood, fire or other unexpected causes.

Requisitions to bring this reserve up to the territory's requirements are made in August—about a half year in advance of the time the materials are likely to be needed.

Just how thoroughly prepared these distributing warehouses were for storm emergencies is strikingly shown by the fact that, although this was the worst storm the Middle West ever had experienced, it was

necessary to ship to the storm area, *by express*, in addition to tools needed for gangs brought in from outside territories, only one carload of bare copper wire and three carloads of insulated wire. For the immediate requirements to restore service temporarily, the warehouse supplies were more than adequate. The materials needed for repairs of a more permanent nature could be shipped by freight without delaying the work of restoration.

The warehouses which were called upon to provide supplies for restoration in this particular case were located at Kansas City, Oklahoma City, Dallas, St. Louis, and Chicago, with a few shipments from Indianapolis.

In addition to the stocks which these warehouses carried, there were even larger reserve stocks at Hawthorne and in the hands of other manufacturing companies, which were holding them ready for instant shipment on the Western Electric Company's order. Some of these stocks, in territorial warehouses and on reserve were: Cross arms, 25,000 in warehouses, 200,000 in reserve; insulators, 100,000 in warehouses, 855,000 in reserve; hardware 375 tons in warehouses, 2,300 tons in reserve; copper wire, 500,000 lbs. (about ten carloads) in warehouses, 1,500,000 lbs. in reserve; and insulated, "twisted-pair" wire, 18,000,000 conductor feet in warehouses and 50,000,000 conductor feet in reserve.

Reserve Stocks of Poles

For the territory affected by this storm, poles were stored at other points. Gulfport and Texarkana, for example, had reserve stocks of creosoted pine poles totaling something like 30,000.

A striking proof of the fact that materials may be mobilized as rapidly as men is afforded in the terse report, received at New York headquarters, to the effect that forty-eight hours after the storm set in one of the distributing points had thirty-two carloads of pine poles

loaded and on their way toward the storm-swept area.

During the first days after the storm, train service was disrupted and express shipments from the distributing houses to the points where materials were needed were irregular. It is recorded that some of the plant superintendents in the field kept a man posted at the express office continually, in order that the shipments might not remain an unnecessary moment in the offices, but might be hurried on their way at top speed.

In getting the materials—and for that matter, the men—to the point where damage was to be repaired, the motor truck fleet of the American Telephone and Telegraph Company and of the various Associated Companies of course did yeoman service. The success of these wheeled workshops—for such they are, so complete is their equipment—in fighting their way over roads that seemed impassable is a tribute to the efficiency of the machines and the courage and resourcefulness of the men who manned them.

Loss Due to Storms Provided For

As was pointed out in an article on sleet storms by Allen C. Crunden in the July, 1922, issue of the *Bell Telephone Quarterly*, suitable financial reserves are imperative in view of the hazards to which the telephone plant is exposed, both from the standpoint of the company, whose property may be destroyed and revenue cut off, and from that of patrons whose business and social needs require substantial continuity of telephone service.

The depreciation reserves of the Bell System are built up by charging to operating expenses regularly in monthly instalments the amounts necessary, on the average, to provide for depreciation costs—including those caused by storms—during the service life of plant.

Devotion to the Public Service

We have seen something, from the standpoint of executive or managerial foresight, of the meaning of

sleet storms—the plan of battle, the strategy, as it were, of the Bell System's fight against the elements. But strategy alone does not win battles. The most carefully laid campaigns must fail unless executed by men upon whose courage, resourcefulness and devotion their leaders may place absolute dependence.

No army ever went into battle with these qualities more clearly shown than they were in the little groups of men who, during the last ten days of 1924, moved into action in their fight to restore a nation-wide telephone service.

They responded to the call for help well knowing that, beyond the shadow of a doubt, they would be kept away from home over the one holiday of the year that means most to the home-loving American. Some of them actually interrupted their Christmas festivities in order to report promptly for duty. Many of the men from the Southern Bell and Cumberland territories were moved overnight from a warm climate into a wind-swept region in which the mercury hovered below or near the zero point for days. They worked without regard to hours, getting their meals and their lodging for the night as best they could.

To these telephone men, and to the employees of other public utilities, whose plant had been hard hit, the St. Louis *Star*, among other papers, paid a richly deserved tribute.

In an editorial published in its issue of December 22, under the title "Heroes of the Storm," the *Star* said:

> "Those who are fortunate enough to have a warm and comfortable home during the severe storm that has held St. Louis in its grip the past three days sometimes give a thought for their less fortunate brothers who are without such shelter. But there is another class of people who suffer unheralded through such weather, among whom may be found many of the real heroes of the storm. These are the members of emergency crews of the public utilities. It is estimated

that five hundred men are struggling to restore the impaired service of the Union Electric; seven hundred are engaged in the colossal task of repairing the telephone lines of the Southwestern Bell Telephone Company, damaged by the falling of thousands of poles, snapped off by their ice-weighted wires. The United Railways has had wrecking crews totaling nearly one thousand men at work trying to complete the job of restoring the forty-seven miles of their lines tied up by the storm. The telegraph companies also are having their share of the burden.

"In each case the job is still a long way from completion, but the work is well under way and the public is showing the patience usually displayed in such emergencies. An occasional tale of individual heroism drifts in, men who worked thirty-six hours without interruption, and to the point of utter exhaustion; others who risked life and limb in their eagerness to accomplish the task in hand; others who endured the cold until frozen members rendered them no longer useful. These are but samples of a long list of acts, which prove that it is only under difficulties that the best in human nature is brought out. Most of the deeds of these men will go unnoticed—many perhaps, because unnoticed, will be unrewarded except for that great feeling of satisfaction that comes to a real man with the knowledge of a task well done."

R. T. BARRETT.

NOTE—Mr. Barrett is of the staff of the Information Department of the American Telephone and Telegraph Company.

The Work of the Bell Telephone Securities Company

IN the April, 1922, issue of the Bell Telephone Quarterly an outline of the work of the Bell Telephone Securities Company was presented. Reference was made to the main function of the Securities Company, which is to disseminate information about Bell System securities to the public, particularly to Bell Telephone users, and the assistance given to several of the Associated Companies in marketing issues of preferred stock was noted. The work of bringing to the attention of the public the investment merits of American Telephone and Telegraph Company stock was then well under way.

The statement was made in the article referred to that there were at that time more than 197,000 stockholders of the American Telephone and Telegraph Company. There are now 345,133 stockholders of the American Company—a gain of nearly 150,000 in two years and nine months. The work of the Securities Company, in co-operation with the Associated Companies, has been an important factor in bringing about this very substantial gain in the number of persons who have become owners of the Bell System.

Soon after the organization of the Securities Company, efforts were begun to interest investors in stock of the American Company. Through the employees of a few of the Associated Companies, with the co-operation of banks, the investment merits of the stock were brought to the attention of telephone subscribers. Full information was supplied and arrangements were made with banks to assist individuals to purchase the stock in the market and in some cases to pay for it in instalments. The results indicated that it was necessary only to acquaint investors with the value of the stock and tell them how it could be obtained in order to interest them financially in the Bell System.

Operating officials of the Bell System throughout the

Union were quick to realize that there were many advantages to the local companies in having their employees interest their own public in becoming owners of the Bell System, and that the employees themselves were eager to have their friends invest in the stock of the American Company.

Very early in our experience it was found that throughout the country there were many small investors who did not have banking connections and who could not be economically reached by established investment agencies, who would buy Bell System securities if they could do so directly through the machinery of the System. This was confirmed by the numerous letters received by the Securities Company from individuals asking if it were possible to buy stock of the American Company direct from the Securities Company.

The Direct Sales Plan

Accordingly, a plan was inaugurated whereby applications for the purchase of stock at the market price are received by employees of certain of the Associated Companies, payments to be made either in cash or in monthly instalments of $10 a share. The number of shares applied for in this way daily is communicated by an officer of each of the Associated Companies involved, directly to the Securities Company in New York, which arranges for the purchase of the stock in the market through investment houses. Purchases may also be made by the general public on similar terms either by mail or in person at the office of the Securities Company at 195 Broadway, New York. An ever increasing use is being made of this plan by small investors and many of the purchasers have written to the Securities Company to express their appreciation of the opportunity to make their purchases through that Company.

Under the plan, in an average period of about eight months during 1923, applications for 141,202 shares of stock were received from 28,309 persons through nine of

the Associated Companies and through the Securities Company's own office. Employees of twelve of the Associated Companies, located in thirty-seven states and the District of Columbia, are now co-operating in the work and in the period of nearly a year, ending December 31, 1924, applications were received through those employees and through the office of the Securities Company for the purchase of 262,247 shares of stock from 46,797 persons. Thus in about one year and eight months, 75,106 persons were enabled to purchase 403,449 shares of American Company stock directly through the Securities Company. The cost to the purchasers of this stock is estimated to be more than $51,000,000.

Of these 75,106 purchasers, nearly half—34,512—applied for an average of 2.7 shares of stock each on the monthly payment basis. The average number of shares applied for under both plans was a little over five per purchaser, and undoubtedly the majority of applications was received from persons without investment banking connections and who would not now be interested financially in the Bell System had not machinery been provided so that those individuals who are relatively unacquainted with investment methods could be aided by the men and women of the telephone organization, with whom they come in contact and whom they trust. The advantages of a widespread distribution of the securities of the Bell System are obvious; no less important is the fact that in bringing about this widespread distribution there have been hundreds of thousands of conferences about the stock of the American Company between the public and telephone employees, in which, even when sales were not made, a better understanding was brought about of the aims and the ideals of the Bell System.

While particular attention has been paid to obtaining a wide distribution of the stock of the American Company, the other securities of the Bell System have not been neglected. Through talks to gatherings of investment bankers and by means of articles in important financial

magazines a greater knowledge of the sound financial structure of the Bell System has been created. Advertising by the Securities Company in financial publications was begun in 1923 and is being continued, and in addition to the anticipated result of creating interest in financial circles about our securities, many inquiries are being received from individual investors.

It has been observed within the last year that editors of investment columns in magazines and newspapers have been giving an increasing amount of space to the merits of American Company stock and have been recommending it to their readers as a safe and conservative investment. One editor has said very aptly that to buy stock in the American Telephone and Telegraph Company is to share in the general growth and expansion of the entire United States. Another editor on the Pacific Coast quoted a statement from F. W. Wolf of the Pacific Telephone and Telegraph Company, in which the latter said:

> "Every subscriber a shareholder" is an extraordinary slogan—it is received at first as a blatant boast; then it becomes a high ideal; and finally it appears to be a splendid possibility. The Bell System, throughout the entire country, is carrying on a work of a very great significance in the redistribution of the shares of the parent American Telephone and Telegraph Company. And California, as expected, has been quick to realize her splendid opportunity. In less than six months more than two and a quarter million dollars has been converted into certificates of the 'universal investment stock' by 2,000 persons who never before had owned a share, and the demand is steadily increasing.
>
> "And what 'high pressure' stock-selling methods were employed? Not a cent paid in commissions; not a reward offered of any kind; just an army of telephone employees, themselves stockholders so

imbued with a sense of loyalty that they wanted to bring others into the Bell family."

The work of the Bell Telephone Securities Company in bringing about a wider distribution of the stock of the American Company conduces to the financial strength an economical financing not only of that Company, but also of the whole Bell System. It does other things: it renders a service to individuals who invest their funds, and it likewise serves the nation by strengthening the national foundations. It promotes thrift and the knowledge and habit of sound investment. Men must not only work; they must deny themselves and save and invest those savings wisely.

The activities of the Securities Company, in co-operation with the Associated Companies, will continue and the ownership of the American Company by the public will spread.

D. F. HOUSTON.

A Recent Commentary on Municipal Ownership in Great Britain

SOME years ago the City of Glasgow in Scotland established a municipal bank. Glasgow had previously undertaken the operation of municipal enterprises requiring a large amount of capital, and this bank was designed to furnish banking service to the people of the city and at the same time to place funds at the command of the municipal authorities. Deposits were attracted by the payment of a rate of interest higher than business men were then paying for short term loans on commercial paper. Thereupon, one of the Town Councilmen, who was not in sympathy with this method of municipal finance, borrowed £50,000 in the open market and deposited it in the municipal bank. At the next meeting of the Glasgow Town Council this enterprising financier exhibited his municipal certificates of deposit and explained to his fellow-Councilmen that he was making a profit of about 1½ per cent. per annum on the transaction. In other words, the funds which the city obtained as deposits in the municipal bank were costing the municipality 1½ per cent. higher interest than was being paid by business men for money borrowed on commercial paper in the open market.

This incident is recounted by Professor James Mavor in his recent autobiography, "My Windows on the Street of the World." Professor Mavor, who is Emeritus Professor of Political Economy in the University of Toronto, will perhaps be remembered chiefly for his "Economic History of Russia." He has, however, given much study in the course of a long and observant life, to the economic problems connected with public ownership of public utilities, and is a recognized authority on this subject. Some years ago Professor Mavor undertook an exhaustive investigation into the history of the government-owned telephone systems in the prairie provinces of western

Canada. The results of his inquiry, so far as it related to the largest of these provincial telephone systems, were embodied in his illuminating volume entitled "Government Telephones: The Experience of Manitoba."

In his present book, which Professor Mavor modestly describes in the preface as an *olla podrida* of his views of life over a period of nearly seventy years, he gives an interesting, though somewhat condensed, account of the so-called "municipal movement" in Great Britain from 1904 to 1906, inclusive.

The "Municipal Movement" in Great Britain

Municipal ownership of public utilities, or "municipal trading" as it is called in British parlance, attained a much greater degree of application in Britain two decades ago than it has ever reached in the United States. In the summers of 1904, 1905 and 1906, Professor Mavor devoted most of his time to a study of the development of municipal enterprise in a number of the principal British cities, with particular reference to the economic consequences of the increase in municipal functions and municipal debts which this development entailed. Professor Mavor is a Scotchman by birth, and his investigations into the results of municipal ownership in Great Britain were made at first hand, while residing in Glasgow, Manchester, London and other cities. During this same period Professor Mavor made a detailed study of the British telephone service, which was then partly under private, partly under municipal, and partly under Post Office operation.

After examining the British experiments in municipal ownership of public utilities, Professor Mavor reached an unequivocal opinion as to their character and prospects. "The history of the recent development of municipal enterprise had shown," he writes, "that it had been forced by means of strenuous propaganda, and that the system resulting from this growth had the precarious

character which all such systems must have. Since the ardor of the propagandists was obviously declining with the exposure of the illusions they had been nourishing, and since the economical unsoundness of many public enterprises was gradually being disclosed, it appeared to me that the municipal ownership movement had run its course; and that while municipal pride and perhaps better management might induce and enable cities to maintain their existing enterprises, it was unlikely that they would embark on a large scale in any others."

In Professor Mavor's opinion the period during which he was pursuing his investigations, the years 1904 to 1906, may be regarded as the high-water mark of municipal enterprise in Great Britain. There were numerous signs of an impending turn in the political tide, which up to that time had swept into office many believers in public ownership. Municipal trading, as Professor Mavor points out, "had been carried far enough to disclose the elements that had been customarily neglected in the presentation of the various projects by their enthusiastic advocates."

The impossibility of preventing municipal politicians from meddling with the technical details of public utility management had already been felt in many cities. In some places, municipal ownership and operation of public service enterprises had admittedly resulted in heavy financial losses. In certain other cities, where municipal undertakings did not disclose deficits, Professor Mavor nevertheless concluded that they "had made a brave appearance on their books only by starving the services or neglecting to provide adequate reserve and depreciation funds."

Failure to make provision for these essential elements in the cost of rendering service would, of course, in time undermine the financial soundness of any public utility. In the meanwhile, however, the British municipalities were faced by the immediate problem of raising the new capital needed for the extension and development of their

public utilities to keep pace with the growth of popular demand for service.

Legal Restrictions on Municipal Financing

This raising of new capital from time to time is a necessary element in the successful management of public utility services. British experience, as outlined by Professor Mavor, clearly shows that municipal operation of such utilities is seriously hampered by the legal restrictions on municipal financing. The complicated safeguards in the form of debt limits and other charter provisions of one kind or another by which municipal borrowing is hedged about, are very necessary for the protection both of the taxpayers and of the holders of municipal bonds. They are a bulwark against the possible extravagance, or worse, of local politicians. Nevertheless, they often make it extremely difficult for cities that have embarked upon extensive municipal enterprises to finance the additions and extensions which are imperative from time to time. To be sure, few public utilities require such large and continuous investments of new capital as are needed in the telephone business to keep pace with the requirements of an ever expanding service. Yet in a growing community, extensions must continually be made in the gas and electricity supply; and local transportation systems are faced, from time to time, by the necessity of extending their lines and adding to their rolling-stock and other equipment.

The British cities of which Professor Mavor writes were obliged, when they desired to borrow money through the British Treasury, to secure the approval of the Local Government Board, an executive agency of the national government. Otherwise the Treasury could not lend. This Board, however, refused to allow itself to be carried away by the popular enthusiasm for municipal trading. It subjected all proposals for municipal undertakings to a hardheaded business analysis; although by so doing its

members made themselves decidedly unpopular with certain so-called "progressives." Despite political attacks, however, the Local Government Board stood by its guns, and frequently prevented municipal politicians from committing their cities to public ownership ventures which the Board regarded as ill-advised.

Limitations of the Market for Municipal Bonds

Even in the absence of legal limitations on municipal financing, extensive adventures in municipal ownership may render borrowing difficult because of the limitations imposed by the investment market. The capital for municipal enterprises, as Professor Mavor points out, is not raised by mortgaging the enterprises themselves. Municipal credit is based solely upon the taxing power. This taxing power, even if not limited by legal restrictions, is subject to certain practical limitations. Communities which are overtaxed fail to attract new industries, and may even lose industries already established. Urban population shifts in accordance with industrial activity; overtaxed towns tend to lose their citizens. Professor Mavor emphasizes the important fact that the prospective investor in municipal securities, therefore, does not consider whether any particular municipal enterprise is on a paying basis. The question that he considers is whether or not the taxing power of the community is sufficient to provide for the payment of all the municipal obligations, and at the same time make up any deficits which may be incurred by the various municipal undertakings.

Municipal ownership of public utilities not only does not increase this taxing power; it actually decreases it by removing from the tax roll the public utility property which would be subject to taxation if it were privately owned. A city, therefore, which might be perfectly well able to maintain its credit on a high level if it confined its activities to ordinary governmental functions, may find it increasingly difficult to float its loans if it

embarks upon extensive public utility undertakings. Its taxing power, and therefore its capacity to borrow, does not increase in proportion to the need of new capital for its public service enterprises. The inevitable consequence is an increase in the rate of interest which it is obliged to pay upon funds borrowed, not only for investment in its municipal utilities, but for any municipal purpose.

The Increasing Costliness of Municipal Financing

This is precisely the situation which, according to Professor Mavor, developed in Great Britain about 1906. His investigations convinced him that the saturation point was then being approached in so far as investment in municipal securities was concerned; and he adds that this conclusion was confirmed "by the widely known fact that many municipalities had found themselves unable to sell debentures and had therefore to borrow temporarily very large sums. * * * * In addition to these floating debts there were unsold debentures in the hands of financial agents who had undertaken to purchase them, but who found themselves unable to induce the public to absorb them. All this meant that greater inducement in the form of an increased rate of interest must be offered by the municipalities to the investing public."

The argument that governmental bodies can always obtain capital at lower rates of interest than privately owned utility corporations was disproved. Moreover, as Professor Mavor remarks, an increase in the rate of interest to be paid by the municipalities would not only adversely affect public opinion in regard to municipal ownership, but might even result in making some municipalities seriously short of funds.

Rate Reductions and Competitive Enterprises

Faced with the necessity of paying higher interest rates for new capital, the municipal utilities in Great

Britain were at the same time confronted with popular clamor for reduction in service charges. At first the demand was merely for "service at cost"; but, says Professor Mavor, "the doctrine speedily began to develop that even if a loss should be incurred through the reduction of public utility rates, this loss could be met from taxation. In obedience to public clamor gas rates were reduced in Glasgow, and a previously well-managed enterprise ceased to be self-supporting, heavy losses being incurred for two years. At the end of that period the rates were raised."

Some of the British municipalities, moreover, found themselves drawn deeper and deeper into municipal ownership by the necessity, real or hypothetical, of protecting the enterprises in which they had already sunk large amounts of public money. Thus "sometimes without any public desire, or even against public inclination," cities having municipal gas-works felt impelled to suppress competition by the acquisition of electric plants. Such ventures, of course, called for the investment of additional capital, not only to meet the first cost of the plant acquired, but to provide for the extension of the service to keep pace with the needs of the public. Having in mind the limitations on municipal financing already mentioned, Professor Mavor expresses the opinion that in cases where, on the ground of assumed necessity, the municipality has acquired a competitive plant, it may have compromised its whole financial position.

Inadequate Salaries and Political Interference

The publicly owned utilities were, moreover, confronted by another difficulty fully as serious as that with respect to financing. They found it extremely hard to secure competent management. At the very time when immense sums were being expended on public utility plant, the salaries offered by the municipalities for public utility executives were totally inadequate. In the pithy

phrase of Professor Mavor, "a furore for civic parsimony very frequently coincided with a furore for civic expenditure." Even where municipal utilities did succeed in securing high-grade executives, their best men were often drawn away before long by the greater pecuniary rewards of private employment.

This condition was, in itself, a serious handicap to utility operation under public ownership. Even under competent management, however, municipal enterprises were exposed to the interference of politicians. "It is not surprising," writes Professor Mavor, "that municipal councils deteriorated. Increase of functions alone resulted in deterioration, because, on the one hand, capable men of business could not afford the increasing drafts upon their time consequent upon the increase of municipal functions, and on the other, such men became more and more reluctant to identify themselves with a municipal policy which they felt could not result otherwise than in discredit. In some cities capable business men were certain to be defeated if they were opposed by enthusiasts for municipal trading."

Although the members of the municipal council may be regarded as the board of directors of the various municipal enterprises, they are, of course, not elected because of any special qualifications for the administration of public business. A candidate for Councilman is elected, as Professor Mavor puts it, "because he belongs to this or that political party, religious denomination or friendly society, or because he is a good speaker or a philanthropic person or an advocate of some municipal scheme. * * * * Instances abound in which candidates highly suitable on the ground of capacity for public business have been defeated by candidates whose claims for election rested on altogether different grounds. Therefore, unless the electors change the ground upon which they elect their representatives who are endowed

with the power of direction of their enterprises, it is clear that these enterprises could not expand indefinitely with safety to the public interest."

The Lesson

The lesson of British experience in municipal ownership, as described by Professor Mavor, is not far to seek. Admittedly, British and American conditions are not the same. Yet many observers believe that the prevailing standards of political capacity and integrity, especially in municipal government, are higher in Great Britain than in the United States. However that may be, Britain's experience with public ownership has shown that the most serious objections urged against such ventures before they were undertaken, were borne out by the results. It was unfortunate that, because of popular disregard of these warnings, "the effects of the operation by municipalities of hazardous and fluctuating enterprises requiring high administrative and technical skill had to be worked out in practice, and losses and disappointments had to be experienced * * * *." For, as Professor Mavor succinctly points out, "the pitfalls in the offer of public services at cost, and in the doctrine that municipalities could obtain money more cheaply than joint-stock companies, were perfectly well known to those who had studied the subject, but they were not apparent to the general public."

Richard Storrs Coe.

The Quarterly as Seen by Its Readers

"Oh, wad some power the giftie gie us
To see oursel's as others see us!"

IN response to the request contained in the last issue of the Quarterly, many persons in various walks of life and from all parts of the country have sent in their comments on the contents of the magazine and explained their reaction to the several articles. These replies are both interesting and instructive; interesting in that they show how widely and how carefully the Quarterly is read, and instructive in that many of them offer suggestions and criticisms both as to the choice of article and the subject matter.

The Bell Telephone Quarterly made its first appearance in April of 1922, and in the short time that has intervened since that date; it seems to have made a great many friends, not alone in the telephone field, but among those who are active in the educational, business and scientific world. The aim from the start has been to provide a magazine which would prove a medium of suggestion, a report of progress and an announcement of results, but the desire has ever been present to make the character and quality of the articles as interesting and as helpful as possible. Hence the blue slip or questionnaire contained in the October issue.

Naturally, no magazine or review could expect that all of its articles would possess an especial appeal for all of its readers. No two persons have identical tastes, and what to one might be intensely interesting, to another would be of only passing moment. The problem, therefore, is to present a publication that will include articles on a variety of important and interesting subjects and written in such a way as to attract and hold the attention of both the technical and the non-technical reader. This, judged by the replies received to the questionnaire, the Quarterly seems to have achieved

in its October issue, but with this difference: the contents as a whole appeal to a larger number of persons than is usually the case with the standard review.

Concerning Mr. Gifford's Article

By far the most popular article was that on "A Publicly Owned Institution," by Mr. W. S. Gifford. This article was praised highly for its clear, concise and convincing presentation of an interesting subject, the vice-president of a Western Railroad writing:

> "All the articles are most ably written, but the extract from the address of Mr. W. S. Gifford, before the Bell System Educational Conference in New York on August 18, 1924, struck us most forcibly as a masterpiece of simplicity in presenting the subject. In other words, it is so plain that a child could understand it thoroughly."

Another reader terms it "The most interesting and convincing brief statement of the Bell System's financial structure, stability and aims I have ever seen."

On the other hand, of the small minority who criticised, several question the advisability of printing the article on the ground that the story had been told before by others and that it did not convey anything new to telephone men, already familiar with the aims, structure and operation of the Bell System. "Others have said the same thing many times before, so why print it?" asks one writer, who adds that speeches by general officials to outside bodies should not necessarily be printed in the Quarterly merely because they are good speeches. Mr. Gifford's talk, in his opinion, was admirably suited for its original purpose, but not for publication in the Quarterly. Two critics term the article repeatative and lacking in style; one finds it rather ordinary and another feels it was too similar in character to that in the same issue by Mr. Blair-Smith on the 1924 stock issue. In this connection, one writer points out that

on page 218 Mr. Gifford refers to the number of stockholders as 340,000 and on page 262 the number is given as 316,046. The latter figure, however, is of June 10, while Mr. Gifford's was based on a later date, a fact which may not have been made entirely clear.

While it is recognized by several that the story is not in its entirety a new one, the general feeling seems to be that it has never before been told so clearly or so well. As a Philadelphia reader writes:

> "This story cannot be told too many times! Always helpful both within and without the organization."

In fact, many readers suggest the desirability of giving the article the widest possible publicity, the assistant general attorney of a western company writing:

> "The address of Mr. Gifford delivered before the Bell System Educational Conference in New York on August 18, which appears in the Bell Quarterly of October, is one that should be placed before every telephone user in the country. If this were done, this vast army of users of a public service would have a clear idea of how this service is brought to their door at such a reasonable cost and just what is necessary to continue furnishing such service. The reading of this article will disabuse the mind of any person that the Bell System is a grasping corporation, one looking only at the profit side of the business. It is the best article for public consumption of a corporation's affairs that I have ever read."

A Telephone official connected with the Michigan Bell Telephone Company writes:

> "Arrangements should be made to give every newspaper publisher and editor in the country a copy of Mr. Gifford's article on 'A Publicly Owned Institution.' A reading of this presentation, terse

and dispassionate as it is, could not fail to impress the reader with its frankness and sincerity.

"The difficulties of our position, especially with reference to financial questions, are in large measure due to an impression that we have some secret interests to serve; that we have not laid all our cards on the table. An attorney in a recent rate case argument claimed the existence in the Bell System of 'hidden profits.'

"A reading of this article which makes a member of the organization proud of his affiliations is bound to create a feeling of confidence in others.

"To bring this article to the attention of thinking people—not by ordinary circularizing methods, but with individual consideration in each instance—would work inestimable good."

A few other comments follow:

A house organ editor—"The article by Mr. Gifford is the best concise definition of the Bell System organization that I have ever read."

A telephone attorney—" 'A Publicly Owned Institution' impressed me most. Articles of this kind have a particularly good effect on the general public and are a powerful factor in improving our public relations."

From Chicago—"Of great interest from the standpoint of both the employee and the stockholder. Its clarity and conciseness make it of special interest."

Mathematics in Industrial Research

"I never appreciated a mathematician before" is the comment of a Milwaukee reader in regard to the article by Dr. George A. Campbell on "Mathematics in Industrial Research." That Dr. Campbell has taken a subject that ordinarily would be difficult for the layman to understand and has succeeded in giving a convincing presentation of the vital part played by mathematics in the telephone business is generally recognized. College

professors state they are bringing the article to the attention of teachers of mathematics and their students.

Undoubtedly the subject does not have the popular appeal such as Mr. Gifford's possessed, and several readers have freely admitted their lack of interest, but the majority found the article both interesting and informative. Typical of this feeling is the opinion of a Chicago reader, who says:

> "Dr. Campbell has succeeded in making it entertaining. Top of page 228 on restrictions very informing. Perspective and imagination required as discussed on last pages should be digested by the student and beginner."

A telephone engineer says:

> "The October 1924 number of the Bell Telephone Quarterly was, I think, the most interesting one to date. All articles were interesting, but particular mention should be made of the article by Dr. Campbell on "Mathematics in Industrial Research," which I found right to the point and splendid throughout."

The retired president of a large company writes:

> "An interesting article for those brought up in the technical side of the business and of interest to engineers generally. Would not think it had any popular appeal."

The very fact that the article does cause the average reader to think along unfamiliar lines is given as an answer to those who might feel that it was a little too technical in character for publication in the Bell Telephone Quarterly. As one telephone man writes:

> "This is the kind of article we like. It tells the average employee something new."

From Harrisburg, Pa., comes the following:

> "A common sense application of the study of mathematics for one of experience. May be a trifle

harder to appreciate by students who have not had an opportunity for practice of mathematics, but well worth their attention and study. An appealing presentation of a subject generally not made so interesting."

A number of readers offered no comment on the article, evidently having considered it a too specialized subject to interest them.

"No doubt," says one, "the article gives necessary variety to the Quarterly and both interests and impresses a certain type of reader. It is genuine labor, however, for the layman to even try to understand it and he reads only a paragraph or two. Believe it should be in the Technical publication."

"The difficulty with the article," says another reader, "is that it is of interest to only a small class." "A bit dry" is the opinion of a trade paper editor who feels that the Quarterly should strive to present information in a less academic fashion, making the magazine a "bit more human, as it were." A Chicago reader felt that it would have been wiser to print the article only in the Bell Telephone Journal and that an abstract would have sufficed for the Quarterly.

Statistics and Business Conditions

"The Statistical Study of General Business Conditions," by Mr. F. E. Richter, proved to be a very appealing article. Not only does it seem to have been carefully read and analyzed, but the charts which accompanied it were likewise studied and some very interesting conclusions reached. As one reader remarked, "It is of great value to all who have a share in any sort of managerial responsibility, anywhere." Another refers to the value of facts vs. prophecy, and caution in their use.

A few brief comments follow:

"Instructive and helpful."

"Very much worth while."

"Good." (Associate editor of a well-known magazine.)

"Brilliant." (Advertising Counsel of one of the nation's biggest department stores.)

"Splendid analysis—particularly interesting."

"This is your best article."

"Of permanent interest to many."

"Illuminating. Good treatment of a subject difficult to portray to ordinary readers."

"Interesting and educational."

"A very instructive article explaining clearly a difficult subject."

"Most interesting to me, and well done." This last from the head of the Department of Chemistry of one of the most famous universities in the country, who adds:

> "I for my part would like to see more articles like that of Richter, in which statistics are studied instead of being merely stated as if they were facts free from all assumption."

One writer felt that while the subject was of interest, it was one that had been greatly overdone since the war. He adds, "Every bank and trust company, large industrial concern, financial editor and a dozen or more 'economic bureaus' have been grinding it out." The following comment comes from Washington, D. C.: "All right from a general business standpoint, but for the telephone man—well, he'd probably prefer something with a more direct bearing on the business." Another writer believes that the words "objective" and "subjective" are too academic to go with the rest of the discussion. A number of readers have no comments to make on this article.

The Rees and King Article

"While the October Quarterly was the best issue yet," reads one comment, "the 'High Spot' was the article on 'Communication Engineering and Electrical Curricula' by Col. R. I. Rees and Dr. R. W. King."

This article seems to have been very widely read and favorably reviewed, the effort to establish the proper contact with college faculties and to emphasize the desirability of improving collegiate curricula to provide courses more suitable for men who are to find their vocation in Bell System work being of particular interest. Several college professors state they are passing the article along to seniors in engineering courses, while another reader feels that, in addition to the telephone field, it would be read with interest by men in the lighting and power and electrical manufacturing interests.

One of the best-known Telephone Pioneers in America, an associate of Dr. Alexander Graham Bell in those early days of the industry, writes as follows:

> "The articles I have checked are exceptionally readable and of the three, my personal appreciation goes to the Rees and King article; which in addition to its readability is, in my judgment, characterized by instructiveness carried out without any loss of interestingness. This article has also a by-product of high merit, in that I believe it does not once refer to the user, customer or patron by the effete and now meaningless term "subscriber." I suppose, however, it might have if it had had occasion to mention him directly. Why not drop it anyhow?"

Here are a few other comments:

"Of particular interest to those handling men."

"This is fine to interest young men."

"Relations with colleges—helpful."

"Excellent and sound—should get results."

"Clearly sets forth the field of employment."

"Of very great interest to any ambitious telephone man."

"This is a crackerjack."

"Unusually well written."

"Entertaining as well as instructive."

"Informational, not striking."

"Intensely interesting; embraces the vast possibilities and personal opportunity."

"To my mind, your best article, because it is both new and constructive."

It was felt by one reader that the title "Communication Engineering and Electrical Curricula" was unfortunate in that it was not inviting to the layman, with the result that a really fine article would be passed up. Apparently this is what did occur, as about ten readers offered no comments at all. Another admitted he was not interested, while a writer from the Middle West asks if subjects of greater interest might not be found. From Chicago comes the wish that something had been inserted about economic studies, while a Pacific Coast reader believes that the point brought out, that the qualities needed by the college man for success in industry are the same as those needed by the non-college man, should be more strongly impressed.

Regarding Financial Articles

Articles which describe specific pieces of work and the way in which they are handled always are of interest, says a St. Louis reader, and accordingly, that by Mr. H. Blair-Smith on "The 1924 Stock Issue of the American Telephone and Telegraph Company" met with much favor. This tremendous piece of financing involved a mammoth economic problem, the details of which proved most interesting and fascinating to the majority of readers. "A regular magazine article," says one. "This is good. Would like more of the business viewpoint," writes another.

From Pennsylvania comes this interesting comment:

> "My personal belief is that a story of this sort ought to have, at the very start off, an epitomizing paragraph or two telling the effort and the result, and that then the article should unfold the detail story, chronologically or in whatever manner seems best. The above would, I think, catch and hold interest better if so started."

There were a few readers who felt that while the story was an interesting one, publication of its details in the Quarterly was more or less a waste of valuable space, because it had already been fairly well disseminated through the press and, in the case of Bell employees, in the different company magazines. However, many found much of real information to them, a Detroit reader writing:

> "I read this first to see if it contained anything new—it did."

From Sacramento, Cal.

> "Questions answered that have occurred to many field people. Such answers always create interest. Outside of New York, we have no opportunity to get such information except by means of such an article."

It was suggested that the article by Mr. Blair-Smith, as also that on "A Publicly Owned Institution," by Mr. Gifford, be printed in leaflet form and given as wide distribution as possible.

Value of Statistics

Facts and figures when they are as interesting as those presented by Mr. C. W. Foss in the article entitled "World's Telephone Statistics, 1923," are certain to command attention and although most of the leading newspapers in the country had already carried news stories giving a summary of the information contained in this article, their publication in the Quarterly, with the accompanying charts and tables, seems to have been appreciated. In fact, several readers deemed the information as of sufficient interest and value to warrant its being published every year, as new figures become available.

"Astounding," writes a college professor, after reading this article. "These figures tell a great story," says another. Several telephone men refer to "the sense of

pride in our country and our industry" which these statistics inspire. Intended rather for purposes of information and as a source of reference than for casual reading, this article evidently has served to convey to many a greater realization of the development and magnitude of the telephone industry and its universality throughout the world. However, it undoubtedly lost some of its value, because the main points had already been published. Some readers who had seen data on the subject did not stop to read the article, while others felt that from such a mass of comparative data little could be retained by memory. One reader thought the information might have been given in less space, inasmuch as the statistics had been considered of such importance as to warrant the issuance of a pamphlet on the subject.

Suggestions and Views in General

"As I look over the last part of the magazine," writes the chairman of the Board of Directors of a large company, "I notice the title 'The Telephone's Part in Defense Test Day.' Here is a subject which I think has a popular appeal. Would be inclined to elaborate it and to have it as a leading article rather than as a casual reference under Current Events. To my mind, a similar article which would be read with interest if well set up would be one on the use of the telephone system and radio in connection with the Presidential campaign. I was much impressed as I listened to President Coolidge's last talk as to the scope of the network of wires involved, and I pictured much could be drawn on the new use of the Bell System."

Among the suggestions offered by various readers was the following from a telephone man, who writes:

> "The rank and file want to hear more from our leaders. It is delightful to know what they are doing and talking about in those topnotch conferences. My only suggestion regarding the October number,

concerns the identity of the contributors. If you find it convenient in the future, I am quite sure all will appreciate an introduction which will fix in mind their official activities."

Two more letters are of interest, the first from a telephone man, who, writing from San Francisco, says:

> "To those of us whose opportunity it is to be connected with the great Telephone organization and whose duty it is to assist in solving the ever present problem of rendering an efficient beneficial service to the public at a satisfactory cost on a basis fair to the owners, the Bell Telephone Quarterly offers a source of enlightenment and help."

From Boston comes the following:

> "The articles are good, the subject matter is weighty—as it should be—the composition is not too weighty, which is, also, as it should be."

It has been most interesting, this opportunity of getting better acquainted with the readers of the Bell Telephone Quarterly. Letters and filled-in questionnaires have come from all parts of the country, expressing the pleasure the perusal of the Quarterly gives and the high regard in which the publication is held, but perhaps most valuable of all—and most helpful—were the ones which contained criticisms. These had to do both with the choice of subjects presented and the treatment of same, and if out of them should come a thought or two which will make the Quarterly more readable and more interesting, the effort will not have been in vain.

Letters inspired by articles in the Quarterly and suggestions that might prove helpful in increasing the interest and influence of the magazine will always be appreciated.

JOHN B. O'BRIEN.

NOTE—Mr. O'Brien is of the staff of the Information Department of the American Telephone and Telegraph Company.—*Editor.*

Editorial

CERTAIN thoughts recur at the beginning of a new year. We review the past and take counsel for the future.

Each individual in the Bell telephone companies has a personal interest in the past record by the System and in the prospects for the future. Each should be encouraged because so much good has been accomplished. Each should look forward with enthusiasm to the fine opportunities which lie ahead. Each man and woman knows the part each has had in making the Bell System what it is today and, therefore, likes to know what their fellow workers all together have accomplished.

It is still too early to give the complete record of last year's results. That will be shown so far as possible in the forthcoming annual reports. It is not too early to describe in a very general way the Bell System of today and what Bell people, working together, have accomplished.

We like to think of the Bell System as an instrumentality of service. The kind of service which the nerves perform for the human body is the kind of service the telephone performs for the body politic which is our nation. Naturally it is an indispensable service and one carrying great responsibility. It must be prompt and dependable, for its failure, like the failure of the nervous system, means paralysis. The Bell System as an instrument of national communication has grown with the nation itself and set a high standard of dependability.

Every new feature of modern life has resulted in a new demand upon the telephone service. So automobiles made their demands for telephone service, so airplanes added new requirements, so radio broadcasting itself, and so every innovation. Each has had to be tied into our daily life by the wires that carry speech. It would take too long to tell of the many new kinds of telephone service which have been devised to meet changing conditions. They range from the taxicab "central" to the

telephone equipment of a power farmer, from the needs of a hospital to those of the motion picture director, from the battleship to the depths of the mine.

But the greatest problems of the telephone companies are not those of new adaptations, but of tremendous growth along the lines of common usage. Growth, always impressive, is nevertheless comparatively simple in most lines of industry. If the shoe business grows, the manufacturer may enlarge his factory, or build more factories and employ a larger force. If the business of the railroad grows, it may add more cars and more tracks. In such cases fundamental inventions or changes in methods may be desirable but they do not become imperative, because of the growth of the business.

How different are the problems resulting from telephone growth. Think of the long list of inventions made necessary by the growth of a single city! A million or more telephones must all be connected so that any telephone can be reached through any other telephone. Think of the inventions which had to be made before fifteen million telephones scattered throughout every state in the Union could be connected in one system, so that anyone anywhere can talk with anyone anywhere else!

The scientists and engineers have discovered and applied the means of solving each of these many problems. All lands have been drawn upon for the raw materials. New apparatus has been developed, tested and put to use. New methods of operation have been tried and approved. Construction has been put through on a nation-wide scale.

Meanwhile, there has been built up an organization of telephone men and women skilled in their work, loyal to its service.

Such is the Bell System of today, an instrument of universal communication, binding together the nation and its innumerable activities.

The Bell System not only grows with the country but

it helps the country to grow. During the past year new developments have been made, resulting in better apparatus and better methods. The property used for telephone purposes has been greatly extended, and the facilities for promptly meeting the many and varied requirements for service have been steadily extended.

That it has been a good year has been due to the fine work of each company, each department and each individual. The record is one of which all may well be proud.

The new year lies before us with increasing responsibilities and correspondingly greater opportunities. Economically, it promises to be a year of better general business conditions, and consequently there should be more demand for telephone service.

New problems of every sort are sure to present themselves. But they can and will be solved. Progress will be needed along many lines but it can and will be made. There is no standing still for the Bell System, because it is a living, growing organism and the enthusiasm of each individual will give him a proud part in the results which all together will achieve.

Nowhere is there to be found a corporate organization which is entrusted with an undertaking of greater magnitude.

Abstracts of Recent Technical Papers from Bell Telephone Sources

Photomechanical Wave Analyzer Applied to Inharmonic Analyzis,[1] by C. F. Sacia. This type of Fourier Analysis deals with wave-forms which are not strictly periodic, since they are of finite duration and of varying cyclic forms. Hence in a finite frequency range they have an infinite number of infinitesimal components (shown by the Fourier Integral) as contrasted with the finite number of finite components at regular intervals (shown by the Fourier Series).

This analyzer utilizes the continual repetition of the aperiodic wave, deriving therefrom a periodic wave, the infinitesimal components neutralizing except for frequencies which are integral multiples of the frequency of repetition; here the components build up to finite magnitudes. The simple relation between these components is seen from the corresponding Fourier Integral and Series identities for the unrepeated and repeated waves respectively. By increasing the period of repetition a new set of components can be similarly derived.

The wave form is represented as a black profile on a transparent strip whose ends are joined to form an endless belt. Driven at constant speed past a transverse illuminated slit, it generates light fluctuations which are converted into electrical fluctuations by means of a selenium cell. A tuned circuit, amplifier, rectifier and microammeter are used to select and measure the components, while the frequencies are determined by the speed of the strip, the frequency of tuning, and the time scale of the original wave form.

"*Demagnetization and Hysteresis Loops*," [2] by L. W. McKeehan and P. P. Cioffi. The fact that permalloy shows its maximum initial permeability in the absence of external magnetic fields is used to check the exact

[1] J. O. S., R. S. I., Vol. 9, pp. 487–494, 1924.
[2] J. O. S., R. S. I., Vol. 9, pp 479–485, 1924.

compensation of the earth's magnetic field or other stray fields by measurement of the initial permeability of a strip or wire of permalloy placed parallel to the field component to be compensated. Increased accuracy is obtained by the use of somewhat greater fields than those which approximately give the initial permeability. The effect of demagnetization by an alternating current field is studied with samples of the same sort, the apparent permeability varying as the external field at the time of magnetization is varied. The dissymmetry in hysteresis loops where the upper and lower limits are unsymmetrical with respect to the zero of magnetic field is illustrated and the detection of such dissymmetry is discussed.

A Classified List of Published Bibliographies in Physics 1910-1922,[3] by Karl K. Darrow. This work, undertaken at the request of the National Research Council, represents an attempt to cope with the problem of providing a convenient and adequate bibliography of physics, not by actually writing a complete classified bibliography (which would fill a huge volume and require the prolonged labor of several men), but by listing the very numerous partial bibliographies under a detailed subject-classification. Many of the accounts of research published in scientific journals contain short histories of the previous work in the subjects which they treat, many others contain lists of references, and there are also a number of critical or uncritical reviews of particular fields with thorough documentations. The *Classified List of Published Bibliographies* refers to all of these which appeared in any of the familiar physical journals between 1910 and 1922 inclusively, and a number of books as well; it is believed that almost every article upon a physical subject, which has ever been cited or reviewed in another article, can be traced through the *List*. The system of classification, in which the field of physics is divided into seventy-five classes with numerous subdivisions, is much the most detailed and elaborate which

[3] Bulletin of the National Research Council, No. 47.

has been made out for the science of physics in a score of years. An adequate system of classification is of great value in any science, for researches which are classified under it are not only made easy to trace, but their various aspects and their mutual relations can be emphasized. Because of the rapid growth and evolution of physics, the earlier systems have mostly become inadequate; but it is hoped to make and keep this system effective by constant attention and revision, and to extend the use of it.

Carrier Telephony,[4] by N. H. Slaughter. Adequate telephone communication facilities are becoming an absolute essential in the operation of modern power transmission systems. The distances to be covered and the physical conditions encountered are making it more and more difficult to satisfactorily provide these facilities by means of physical telephone lines. Accordingly, the past few years have witnessed a rapid development of the use of carrier currents on the power transmission lines as an auxiliary or substitute for the physical telephone lines. The carrier method usually gives a more reliable circuit than the privately owned wire circuits of the power companies, and should be more economical.

Among the most difficult technical problems encountered in this development has been the provision of safe and efficient means of connecting the high voltage lines and the carrier telephone equipment. High voltage coupling condensers offer the best present solution technically, but are more expensive than the alternative of coupling wires or antennas.

Commercial equipment (of Western Electric manufacture) now in rapidly increasing use by power companies provides two-way communication comparable with standard telephone lines, with facilities for selective ringing, and extension through P.B.X.'s at terminals. Multiplex channels can be provided if the need arises.

[4] Electrical Communication, Vol. III, pp. 127–133, 1924. Another article on the same subject appears in the January, 1925, issue of the Bell System Technical Journal.

Simplicity, ruggedness, reliability and low maintenance cost have been the controlling factors.

The future expansion and growth of power transmission systems will call for an increasing use of Carrier Telephony.

Transmitting Equipment for Radio Telephone Broadcasting,[5] by Edward L. Nelson. The general transmission considerations applying to any system for the high quality transmission of speech or music are outlined briefly, and the specific requirements to be met by the various apparatus units in a radio broadcasting equipment are discussed in some detail. The standard Western Electric 500-watt broadcasting equipment, which has found application in some fifty of the larger stations in this country and abroad, is described. Its performance capabilities are illustrated and it is indicated that a standard of performance has been attained which renders possible reproductions not substantially different from the original.

"The Vapor Pressures of Rochelle Salt, the Hydrates of Sodium and Potassium Tartrates and Their Saturated Solutions,"[6] by H. H. Lowry and S. O. Morgan. The vapor pressures were determined by a static method at several temperatures between 15° and 40°. Temperatures were controlled to ± 0.1° and the pressures read to ± 0.1 mm. The measurements on the saturated solution of Rochelle salt show that the solid phase in such a solution is unstable above 40°, in agreement with other investigators.

Minimal Length Arc Characteristics,[7] by H. E. Ives. This paper is a study of the electrical discharges which occur between opening contacts. It is found that the discharge occurring when currents below a certain value are broken are atmospheric sparks corresponding to a definite breakdown voltage, which in the case of air

[5] Proc. of The Inst. of Radio Engineers, Vol. XII, page 553, 1924.
[6] Jour. Am. Chem. Soc., Vol. 45, pp. 2192–2196, 1924.
[7] Jour. of the Franklin Institute, Vol. 198, pp. 437–474, 1924.

is about 300 volts. Above a critical value of current, which is different for every material, the discharge is an arc, in which the voltage corresponding to the discharge varies with current. Spectrograms taken in the two regions show only the air spark spectrum for all materials below the critical current and the arc spectra of the materials above the critical current. The characteristic equations of the arcs caused by the opening contacts are derived and are used to obtain expressions for the current vs. time relations at the opening contact.

The Dependence of the Loudness of a Complex Sound Upon the Energy in the Various Frequency Regions of the Sound,[8] by H. Fletcher and J. C. Steinberg. Two complex sounds were studied, one with a continuous energy frequency spectrum corresponding to connected speech, the other a test tone having discrete frequency components. By means of filters the energy was removed from all frequencies either above or below a certain frequency, and the resulting decrease in loudness was measured by attenuating the original sound without distortion until equal in loudness to the filtered sound. Taking the average results for six observers, this decrease was found to depend on the absolute values of the loudness. For a loudness of 22 units above threshold, each frequency region contributes to loudness in proportion to the energy in that region weighted according to the threshold energy for that frequency. For a loudness above 30 units, however, this is no longer true, because of the nonlinear character of the response of the ear. By assuming each frequency region contributes in proportion to a fractional power of the weighted energy of that region, values of the total loudness in agreement with observed values are obtained if proper values are taken for the fractional power, decreasing to one third as the loudness increases to 100 units.

Correlation Between Crack Development in Glass While Conducting Electricity and the Chemical Composition of

[8] Physical Review, Vol. 24, page 306, 1924.

the Glass,[9] by Earle E. Schumacher. A study was made of the susceptibility to crack development shown by five different kinds of glass when they were subjected to the action of an electric current. The results indicated that the tendency to crack increased with increasing alkali content of the glass and with increasing electrical conductivity.

Report of the Chairman of the Telegraphy and Telephony Committee of the American Institute of Electrical Engineers,[10] by O. B. Blackwell. This report gives a brief summary of the advances which have been made or which have come into prominence in the communication art during the year. Papers which have been presented before the Institute and which, in general, have recorded such advances, are reviewed.

Theorems Regarding the Driving-Point Impedance of Two-Mesh Circuits,[11] by Ronald M. Foster. The necessary and sufficient conditions that a driving-point impedance be realized by means of a two-mesh circuit consisting of resistances, capacities and inductances are stated in terms of the four roots and four poles (including the poles at zero and infinity) of the impedance. The roots and the poles are the time coefficients for the free oscillations of the circuit with the driving branch closed and opened, respectively. For assigned values of the roots, the poles are restricted to a certain domain, which is illustrated by figures for several typical csaes; the case of real poles which are not continuously transformable into complex poles if of special interest. All driving-point impedances satisfying the general conditions can be realized by any one of eleven networks, each consisting of two resistances, two capacities, and two self-inductances with mutual inductance between them; these are the only networks without superfluous elements by which the entire range of possible impedances can be realized;

[9] Jour. Am. Chem. Soc., Vol. XLVI, No. 8, August 1924.

[10] Jour. Am. Inst. of Elec. Engs., Vol. 43, page 1083, 1924.

[11] Bell System Tech. Jour., Vol. III, page 651, 1924.

the three remaining networks of this type give special cases only. For each of these eleven networks, formulas are given for the calculation of the values of the elements from the assigned values of the roots and poles.

Transmission Characteristics of Electric Wave-Filters,[12] by Otto J. Zobel. The transmission loss characteristic of a transmitting network as a function of frequency is an index of the network's steady-state selective properties. Methods of calculation heretofore employed to determine these characteristics for composite wave-filters are long and tedious. This paper gives a method for such determinations which greatly simplifies and shortens the calculations by the introduction of a system of charts. Account is taken of the effects of both wave-filter dissipation and terminal conditions. The method is based upon formulas containing new parameters, called "image parameters," which are the natural ones to use with composite wave-filters.

A detailed illustration of the use of this chart calculation method is given and the transmission losses so obtained are found to agree, except for differences which in practice are negligible, with those obtained by long direct computation.

In the Appendix are derived two sets of corresponding formulas which are applicable to a linear transducer of the most general type, namely, an active, dissymmetrical one; the one set contains image parameters and the other set recurrent parameters. An impedance relation is found to exist between the four open-circuit impedances of a linear transducer even in the most general case. Reduction of these formulas to the more usual case of a passive linear transducer is also made, those containing the image parameters being especially applicable to the case of composite wave filters.

Selective Circuits and Static Interference,[13] by J. R. Carson. This paper is an application of a general mathe-

[12] Bell System Tech. Jour., Vol. III, page 567, 1924.

[13] Trans. A. I. E. E., 1924.

matical theory to the question as to the possibilities and limitations of selective circuits when employed to reduce "Static" interference. In the case of static interference and random disturbances in general the random and unpredictable character of the disturbances makes it necessary to treat the problem statistically and express the results in mean values. In spite of the meagre information available regarding the character and frequency distribution of static, this treatment of the problem yields general deductions of practical significance. The conclusion is reached that for given signal requirements there is an irreducible residue of static interference which cannot be eliminated. This limit is closely approached when a filter of only two or three sections is employed as the selective circuit, and only a negligible further gain is made possible by the most elaborate circuit arrangements. A formula is also given for calculating the relative figures of merit of selective circuits with respect to random interference.

The Building-Up of Sinusoidal Currents in Long Periodically Loaded Lines,[14] by J. R. Carson. When an electromotive force is suddenly applied to a long line an appreciable time is required before the steady-state is established at the distant end; that is, the currents require time to build-up. This effect is particularly marked in coil loaded lines and in long lines of the type is a matter of engineering concern which must be taken into account in designing the lines. This is a consequence of the fact that the character and duration of the building-up process are important criteria of the excellence of the transmission system. In this paper relatively simple formulas are deduced which supply the required engineering information regarding the building-up process in terms of simple, easily calculated parameters of the line. The paper includes the mathematical theory which is based on the Fourier Integral.

[14] Bell System Tech. Jour., Vol. 3, pp. 558–566, 1924.

The Guided and Radiated Energy in Wire Transmission,[15] by J. R. Carson. This is a mathematical analysis of wave propagation along guiding wires from the fundamental equations of electromagnetic theory. It is shown that the engineering theory of wire transmission is incomplete, and that, in addition to the transmitted wave of engineering theory, an infinite series of complementary waves exist. It is through these waves that the phenomena of radiation are directly accounted for. Except for the phenomena of radiation, however, the complementary waves are of theoretical rather than practical interest in present-day transmission practice, and except in extreme cases they may be ignored in practice without appreciable error.

The Stethophone, an Electrical Stethoscope,[16] by H. A. Frederick and H. F. Dodge. The limitations of the ordinary acoustic stethoscope have hindered the teaching of physical diagnosis by auscultation; that is, listening to the sounds set up in the body by the action of the heart and lungs. The electrical stethoscope has been developed to enable classes or even very large audiences to listen simultaneously to these sounds. A special type of transmitter is held by the doctor against the body of the patient. The electric currents from this transmitter are largely amplified and distributed to a large number of telephone receivers. The members of the audience or class listen to these receivers through earpieces similar to those of the ordinary acoustic stethoscope.

The paper discusses the problem of such electrical reproduction. The frequency characteristics of the common types of acoustic stethoscopes have been measured and are given in detail, as are also the frequency characteristics of the transmitter, amplifier and output receiver of the electrical stethoscope. This device is equipped with a series of electrical filters by which it is possible to accentuate certain of the sounds of interest, facilitating

[15] Jour. A. I. E. E., Oct., 1924.

[16] Bell System Tech. Jour., Vol. III, pp. 531-550, 1924.

their observation, particularly in the case of students or others not thoroughly familiar with them.

It has been found that, unlike speech, all the sounds of interest in auscultation are of quite low frequencies.

Preliminary data are given, showing records taken with this device on a recording Einthoven galvanometer, together with records taken simultaneously by the ordinary electrocardiographic method.

Sound Magnification and Its Application to the Requirements of the Deafened,[17] by Harvey Fletcher. A general description of the generation and propagation of sound waves was given and experiments performed to illustrate the principles involved. The general requirements for aiding persons having various amounts of deafness were outlined. The relation between the loudness of speech received by the ear in a room of average acoustic characteristics and the distance the speaker is away from the ear was illustrated by a chart. Also, a chart showing the characteristic frequency regions and loudness levels of the fundamental speech sounds, and one showing the interpretation of speech at various loudness levels by persons having various degrees of hearing, were exhibited. By means of these three charts it was shown how one could predict the amount of intelligibility which would be obtained by a person having a definitely measured amount of hearing. In particular it was pointed out that such sounds as *th*, *f*, and *v* will be the first sounds to be lost as the hearing decreases. These sounds are the easiest ones to detect by lip reading so that hearing aids and lip reading go hand in hand

[17] Lecture given before the Annual Conference of the American Federation of Organizations for the Hard of Hearing, Washington, D. C., Thursday, June 5, and published in Volta Review, September, 1924.

A large number of the audience who listened to this lecture were hard of hearing. A rough measurement of the amount of hearing of each of those present was made and groups arranged according to the degree of hearing. The amplification was then adjusted to each group to suit their particular needs. The results seemed to be most gratifying, as nearly everybody said that it was the first time they ever heard a public lecture of this sort without difficulty since they had become hard of hearing.

in aiding one who is hard of hearing to obtain the proper interpretation.

Abstract of a Telephone Transmission Reference System,[18] by L. J. Sivian. The subject is dealt with in four parts: A—The function of a transmission reference system; B—Requirements to be met by the reference system; C—Work done on the construction and calibration of a preliminary model of the new reference system; D—Proposed future development of the new reference system in its final form to be adopted as the standard for the Bell System.

A brief discussion of the methods and apparatus entering into the general problem of rating telephone transmission is given. It is concluded that a physical reference system is essential, and that a mere specification of its physical operating characteristics is insufficient. The inadequacy of the reference systems now in use is pointed out.

The conditions to be aimed at in the new reference system are: I—The performance of the system and of its component parts must be specifiable in terms of quantities admitting of definite physical measurement; II—The performance of the reference system, under specified operating and atmospheric conditions, must remain constant with time; III—The reference system must be free from non-linear distortion over the range of acoustic and electric amplitudes which it must handle; IV—The frequency response over the range of speech frequencies must be as nearly uniform as possible.

Of the above, conditions I and II are regarded as the most important. It is also proposed to build auxiliary reference systems which will meet conditions I and II while falling short of III and IV. These are needed for purposes of ready comparisons with the commercial circuits commonly in use.

[18] Electrical Communication, Vol. III, pp. 114-126, 1924.

Notes on Recent Occurrences

TELEPHONE PIONEERS OF AMERICA

AT the eleventh annual meeting of the Telephone Pioneers of America, which was held in Chicago, October 9 to 11, 1924, the following officers were elected:

President: Ben S. Read, President of the Southern Bell and Cumberland Telephone and Telegraph Companies. Vice-Presidents: F. A. Stevenson, Director of the Long Lines Department of the American Telephone and Telegraph Company; A. E. Berry, President of the Chesapeake and Potomac Telephone Company; D. P. Fullerton, Vice-President of the Pacific Telephone and Telegraph Company, and W. R. Abbott, President of the Illinois Bell Telephone Company.

The Executive Committee for the next year will consist of B. A. Kaiser, Special Representative of the American Telephone and Telegraph Company; E. D. Nims, President of the Southwestern Bell Telephone Company; E. K. Hall, Vice-President of the American Telephone and Telegraph Company; Miss Ida Krebs, Cashier, Ohio Bell Telephone Company; and Henry McDonald, Commercial Representative of the American Telephone and Telegraph Company in Boston.

The report on membership showed a net gain in membership of 3,262 since January 1, 1923, there now being thirty-three chapters and a total active membership of 7,796.

CONFERENCE OF BELL SYSTEM PRESIDENTS

A PRESIDENTS' conference of the Bell System was held in New York on December 4, which continued for four days, and matters which related to the System as a whole were given careful consideration. Particular attention was given to the budget for 1925, which was discussed at length in view of the prospective needs of

each operating company. It was the consensus of opinion that there would be an improvement of general business conditions during 1925 which would be reflected in increased demands for facilities.

It was developed that in some localities a greater margin of telephone plant was desirable, but generally the demands for additional telephone stations could be promptly met, and the plant condition was better than it has been since the pre-war period.

Altogether the conference was pronounced by visiting presidents as being very successful and at the dinner given by Mr. Thayer on behalf of the American Telephone and Telegraph Company, a very optimistic feeling on the part of all was manifested.

GENERAL COMMERCIAL ENGINEERING CONFERENCE

THE first conference of Bell System Commercial Engineers was held in New York December 10-17, inclusive. While the subject of commercial engineering had previously received considerable discussion in conferences attended by the General Commercial Managers or Superintendents, this was the first opportunity the Commercial Engineers of the Associated Companies have had to meet those dealing with corresponding problems in other territories and to discuss the subject as a group. A large number of topics was presented and discussed in considerable detail by the members of the companies.

The subjects covered consisted primarily of rate and commercial survey problems. As bearing on both of these kinds of work, extended consideration was given to the forecasting of business conditions and to methods of utilizing such forecasts in estimating station growth and revenues. This was followed by a presentation of methods used for estimating population and telephone development—estimates that are necessary

in the economical planning of the telephone plant. Commercial survey methods were considered in detail with reference to both short period and long term forecasts.

Many of the fundamental conditions underlying satisfactory exchange and toll rates and practice were discussed and various technical features of telephone rate making were considered in detail. The increasing investment per station necessary in giving both exchange and toll service, and the higher price levels prevailing since the war, have made a reconsideration of rate treatment necessary in order to insure that the entire plant is used with the maximum economy. Analysis and discussion of the results obtained from the various rate practices now in effect open the way for considering still further refinements and greater consistency in both exchange and toll rate treatments. Particular attention was devoted to private branch exchange rates. This class of service has grown very rapidly and has come to be of great importance. Ways and means were considered for improving the rate treatment in order to encourage the fullest and most economical development of the service as well as to secure greater consistency in the rates.

Methods of compensating the connecting companies for services performed on messages interchanged with the Bell System were discussed, this matter being closely related to rate making. Recent developments in commercial sales work were also outlined.

During the week the conference was addressed by a number of the executives and other members of the American Company and in each case the very great importance of close co-operation between the different functional departments was stressed. It was brought out that although specialization is necessary, Commercial Engineers must not only be good engineers but good commercial men as well.

ORGANIZATION OF BELL TELEPHONE LABORATORIES, INC.

ON December 17, 1924, the following announcement was issued by W. S. Gifford, Executive Vice-President of the American Telephone and Telegraph Company:

"The growth of the research and development work of the Bell System now carried on in the Department of Development and Research of the American Telephone and Telegraph Company and in the Bell System laboratories operated by the Western Electric Company has made a rearrangement of organization advisable. In order that the continuous program of research and development necessary to the progress of the System should be carried on in the most efficient manner a closer co-ordination of all phases of the work under a single executive has been found desirable.

"The following changes in organization will therefore be effective on January 1, 1925:

"A. Vice-President J. J. Carty, in addition to other duties as a Vice-President, will become Chairman of an Advisory Board on Development and Research Policies, and Chairman of the Board of Directors of the Bell Telephone Laboratories, Incorporated.

"B. Mr. F. B. Jewett, at present Vice-President in charge of the Telephone Department, Western Electric Company, has been elected Vice-President of the American Telephone and Telegraph Company, and will have charge of the Department of Development and Research.

"C. An Advisory Board on Development and Research Policies will be created. It will consist of Vice-President J. J. Carty, Chairman, and Vice-Presidents E. S. Bloom, B. Gherardi and F. B. Jewett. It will consider and advise on all matters of policy affecting the character and scope of research and development work for the Bell System.

"D. Bell Telephone Laboratories, Incorporated, will be formed. This new company will be owned and administered jointly by the American Telephone and

Telegraph Company and the Western Electric Company.

The Directors of the new company will be:

J. J. Carty	B. Gherardi	J. L. Kilpatrick
C. G. DuBois	W. S. Gifford	J. B. Odell
	F. B. Jewett	

"Mr. J. J. Carty will be Chairman of the Board and Mr. F. B. Jewett, as Vice-President in charge of Development and Research of the American Telephone and Telegraph Company, will be President.

"Mr. E. B. Craft, the present Chief Engineer of the Western Electric Company, will be Executive Vice-President, and Mr. E. P. Clifford, at present Commercial Manager of the Western Electric Company's Engineering Department, will be Vice-President.

"Mr. J. W. Farrell will be Secretary of the new company and Mr. W. B. Wallace, Treasurer. Mr. J. G. Roberts will be General Patent Attorney, charged principally with the duty of soliciting patents.

"Except for the addition of the Patent Department as one of the constituent operating units, the organization and function of the laboratories will be substantially that of the Western Electric Company's present Engineering Department.

"The new company will take over the property of the Western Electric Company now operated by its Engineering Department at 463 West Street, New York City, and elsewhere."

AWARD OF HENRY MARION HOWE MEDAL

MR. F. F. LUCAS of the Engineering Department of the Western Electric Company has been awarded the Henry Marion Howe Medal for the paper of highest merit published in the Transactions of the American Society for Steel Treating. Mr. Lucas for some years has been engaged on the use of the microscope in connection with the study of the structure of materials and his paper was entitled "High Power Photomicrography of Metallurgical Specimens."

Organization Changes

American Telephone and Telegraph Company

Dr. Frank B. Jewett elected Vice President in charge of Development and Research activities.

Entered employ of the American Telephone and Telegraph Company as Transmission Engineer, 1904; Assistant Chief Engineer of the Western Electric Company, 1912, in charge of all development and research work; elected Vice President of the Western Electric Company in charge of manufacturing, 1921.

Lloyd B. Wilson appointed Commercial Engineer.

Entered employ of the Bell System July, 1899, as Night Operator with the Nebraska Telephone Company, Plattsmouth, Nebr.; Inspector's Helper, Lincoln, Nebr., July, 1901; Local Manager, Central City, Nebr., 1903; District Commercial Manager, 1909; Division Commercial Superintendent, March, 1913; transferred to the Northwestern Group as Special Agent, Omaha, November, 1916; Division Commercial Superintendent, Minneapolis, May, 1917; General Commercial Superintendent, May, 1919; Commercial Engineer, American Telephone and Telegraph Company, January 1, 1925.

L. N. Stoskopf appointed General Plant Manager, Long Lines Department.

Entered employ of the Bell System as a repeaterman, American Telephone and Telegraph Company, July, 1905; transferred to the Chicago Telephone Company, September, 1913; transferred to the American Telephone and Telegraph Company, Chicago, as Division Supervisor of Leased Wires, January, 1914; District Plant Chief, Cleveland, December, 1914; Service Supervisor, Long Lines Department, New York, November, 1920; General Plant Manager, September 22, 1924.

NORTHWESTERN BELL TELEPHONE COMPANY

Frank Bracelin appointed General Commercial Superintendent.

Entered employ of the Bell System, January, 1913, as District Commercial Manager, Northwestern Bell Telephone Company, Fargo, N. D.; Division Commercial Superintendent and Assistant Secretary, Minneapolis, May 20, 1919; Division Commercial Manager and Assistant Secretary, Minneapolis, May, 1922; General Commercial Superintendent, Omaha, January 1, 1925.

SOUTHERN BELL TELEPHONE AND TELEGRAPH COMPANY
CUMBERLAND TELEPHONE AND TELEGRAPH COMPANY

Carroll O. Bickelhaupt appointed Vice President in charge of operation.

Dakota Central Telephone Company, intermittent duties during schooling, 1904-1911; Plant Department, New England Telephone and Telegraph Company, 1911; Traffic Department, New York Telephone Company, 1911; Commercial Engineer's Division, American Telephone and Telegraph Company, 1911; General Commercial Problems Engineer, 1918; Toll Traffic Engineer, 1922; Commercial Engineer, 1922.

SOUTHWESTERN BELL TELEPHONE COMPANY

O. W. Ficklin appointed General Plant Manager.

Entered employ of Bell System as a lineman with the Central Union Telephone Company, Chicago, January, 1900; transferred to the Missouri and Kansas Telephone Company as Assistant Construction Engineer, February, 1910; District Plant Engineer, Missouri and Kansas Telephone Company, July, 1912; transferred to the Southwestern Bell Telephone Company, as Special Agent, August, 1912; Division Plant Superintendent, June, 1919; Assistant to General Manager, July, 1920; Plant Superintendent, April, 1921.

PACIFIC TELEPHONE AND TELEGRAPH COMPANY

H. D. Pillsbury elected President.

Entered employ of the Bell System with the Sunset Telephone and Telegraph Company, San Francisco, approximately 1893; General Attorney, Pacific Telephone and Telegraph Company, San Francisco, 1907; Vice President and General Attorney, March, 1913; elected President, January 1, 1925.

A. H. Griswold elected Vice President.

Entered employ of the Bell System with the Western Electric Company, Chicago, August, 1901; transferred to the Pacific Telephone and Telegraph Company as Plant Engineer, San Francisco, January, 1905; furloughed on military service June, 1917, to March, 1919; returned to Western Electric Company in charge of special engineering commission to Europe, April, 1919; Assistant Chief Engineer, International Western Electric Company, February 15, 1920; Assistant Vice President, American Telephone and Telegraph Company, March, 1921; Vice President, Southern California Telephone Company, Los Angeles, December, 1923; Vice President, Pacific Telephone and Telegraph Company, San Francisco, January 1, 1925.

J. C. Nowell appointed General Manager, Northern Division.

Entered employ of the Bell System as Inspector and General Wire Chief, Bell Telephone Company of Pennsylvania, Philadelphia, 1895; Plant Superintendent, 1904; Plant Manager, 1910; General Manager, Pacific Telephone and Telegraph Company, San Francisco, March, 1913; Vice President and General Manager, August, 1919; General Manager, Northern Division, Pacific Telephone and Telegraph Company, January 1, 1925.

N. R. Powley appointed General Manager, Southern Division.

Entered employ of the Bell System July, 1908, in the statistical division of the American Telephone and Telegraph Company, Boston; transferred to statistical division, New York, September, 1909; transferred to Executive Department, January, 1911; Toll Rate Engineer, Pacific Telephone and Telegraph Company, San Francisco, March, 1912; Commercial Superintendent, Southern California Telephone Company, Los Angeles, September, 1919; General Manager, Southern Division, Pacific Telephone and Telegraph Company, January 1, 1925.

WESTERN ELECTRIC COMPANY

J. L. Kilpatrick elected Vice President in charge of service to telephone companies.

Plant Department, Bell Telephone Company of Pennsylvania, 1895; Engineer of Buildings and Equipment, 1908; Division Plant Superintendent, 1915; Assistant Vice President and General Manager, 1917; General Manager, Installation Department, Western Electric Company, 1922; Assistant Vice President, 1924.